Civil Engineering (CE)

EN010301A   ENGINEERING MATHEMATICS   II
(Common to all branches except CS & IT)

Teaching scheme   **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives

- *To apply standard methods and basic numerical techniques for solving problems and to know the importance of learning theories in Mathematics.*

MODULE 1   Vector differential calculus   (12 hours)

Scalar and vector fields – gradient-physical meaning- directional derivative-divergence an curl - physical meaning-scalar potential conservative field- identities - simple problems

MODULE 2   Vector integral calculus   (12 hours)

Line integral - work done by a force along a path-surface and volume integral-application of Greens theorem, Stokes theorem and Gauss divergence theorem

MODULE 3   Finite differences   (12 hours)

Finite difference operators Δ, ∇, E, μ and δ - interpolation using Newtons forward and backward formula – problems using Stirlings formula, Lagrange's formula and Newton's divided difference formula

MODULE 4   Difference Calculus   (12 hours)

Numerical differentiation using Newtons forward and backward formula – Numerical integration – Newton's – cotes formula – Trapezoidal rule – Simpsons $1/3^{rd}$ and $3/8^{th}$ rule – Difference equations – solution of difference equation

MODULE 5   **Z** transforms   (12 hours)

Definition of   Z   transforms – transform of polynomial function and trignometric functions – shifting property , convolution property - inverse transformation – solution of 1st and 2nd order difference equations with constant coifficients using Z transforms.

Reference

1. Erwin Kreyszing – Advance Engg. Mathematics – Wiley Eastern Ltd.
2. B.S. Grewal – Higher Engg. Mathematics - Khanna Publishers
3. B.V. Ramana - Higher Engg. Mathematics – McGraw Hill
4. K Venkataraman- Numerical methods in science and Engg -National publishing co
5. S.S Sastry - Introductory methods of Numerical Analysis -PHI
6. T.Veerarajan and T.Ramachandran- Numerical Methods- McGraw Hill
7. Babu Ram – Engg. Mathematics -Pearson.
8. H.C.Taneja Advanced Engg. Mathematics Vol I – I.K.International

EN010 302 Economics and Communication Skills
(Common to all branches)

Teaching scheme
2hours lecture and 2 hours tutorial per week   **Credits: 4(3+1)**
Objectives
- To impart a sound knowledge of the fundamentals of Economics.

Economics
Module I (7 hours)
Reserve Bank of India-functions-credit control-quantitative and qualitative techniques
Commercial banks-functions- Role of Small Industries Development Bank of India and National Bank for Agriculture and Rural Development
The stock market-functions-problems faced by the stock market in India-mutual funds

Module II (6 hours)
Multinational corporations in India-impact of MNC's in the Indian economy
Globalisation-necessity-consequences
Privatisation-reasons-disinvestment of public sector undertakings
The information technology industry in India-future prospects
Module III (6 hours)
Direct and indirect taxes- impact and incidence- merits of direct and indirect taxes-progressive and regressive taxes-canons of taxation-functions of tax system-
tax evasion-reasons for tax evasion in India-consequences-steps to control tax evasion
Deficit financing-role-problems associated with deficit financing

Module IV (5 hours)
National income-concepts-GNP, NNP, NI, PI and DPI-methods of estimating national income-difficulties in estimating national income
Inflation-demand pull and cost push-effects of inflation-government measures to control inflation

Module V (6 hours)
International trade-case for free trade-case for protectionism
Balance of payments-causes of disequilibrium in India's BOP-General Agreement on Tariffs and Trade-effect of TRIPS and TRIMS in the Indian economy-impact of WTO decisions on Indian industry

Text Books
1. Ruddar Datt, Indian Economy, S.Chand and Company Ltd.
2. K.K.Dewett, Modern Economic Theory, S.Chand and Company Ltd.
References
1. Paul Samuelson, Economics, Tata McGraw Hill
2. Terence Byres, The Indian Economy, Oxford University Press
3. S.K.Ray, The Indian economy, Prentice Hall of India
4. Campbell McConnel, Economics, Tata McGraw Hill

Communication Skills

Objectives
- To improve Language Proficiency of the Engineering students
- To enable them to express themselves fluently and appropriately in social and professional contexts
- To equip them with the components of different forms of writing

MODULE – 1 (15 hours)
INTRODUCTION TO COMMUNICATION
Communication nature and process, Types of communication - Verbal and Non verbal, Communication Flow-Upward, Downward and Horizontal, Importance of communication skills in society, Listening skills, Reading comprehension, Presentation Techniques, Group Discussion, Interview skills, Soft skills

MODULE – II (15 hours)
TECHNICAL COMMUNICATION
Technical writing skills- Vocabulary enhancement-synonyms, Word Formation-suffix, affix, prefix, Business letters, Emails, Job Application, Curriculum Vitae, Report writing-Types of reports

Note: No university examination for communication skills. There will be internal evaluation for 1 credit.

REFERENCES
1. The functional aspects of communication skills, P.Prasad and Rajendra K. Sharma, S.K. Kataria and sons, 2007
2. Communication skills for Engineers and Scientists, Sangeeta Sharma and Binod Mishra, PHI Learning private limited, 2010
3. Professional Communication, Kumkum Bhardwaj, I.K. International (P) House limited, 2008
4. English for technical Communication, Aysha Viswamohan, Tata Mc Graw Publishing company limited, 2008

CE010 303: FLUID MECHANICS

Teaching scheme: **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objective
- *This course gives an introduction to the fundamentals of fluid flow and its behavior so as to equip the students to learn related subjects and its application in the day to day life in a very effective manner.*

Module 1(12hours)
    Properties of fluids: Definition and Units- Mass density, Specific weight, Viscosity – Classification of fluids – Ideal and real fluids, Newtonian and non – Newtonian fluids.
    Fluid pressure – Atmospheric, Absolute, Gauge and Vacuum pressure, Measurement of pressure – Piezometer, manometer, mechanical gauges.
    Total pressure and centre of pressure on a submerged lamina, pressure on a submerged curved surface – pressure on lock gates, pressure on gravity dams.

Module 2(12hours)
    Buoyancy – Centre of buoyancy – Metacentre – Stability of floating and submerged bodies – Determination of metacentric height – Analytical & experimental methods.
    Kinematics of fluids : Methods of describing fluid motion:Legrangian& Eulerian methods-Types of flow – Streamline, Path line and Streak line, Velocity potential function, Stream function, Circulation and Vorticity, Laplace's Differential equation in rectangular co-ordinates for two dimensional irrotational flow.
    Flow Net – Orthogonality of stream lines and equipotential lines.
    Stream tube – continuity equation for one dimensional flow.

Module 3(12hours)

    Forces influencing motion – Energy of fluids, Euler's equation, statement and derivation of Bernoulli's equation and assumptions made.
    Applications of Bernoulli's equation – Venturi meter, Orifice meter, Pitot tube.
    Orifices and Mouth Pieces – Different types of orifices,flow over a sharp edged orifice- flow through large rectangular orifice- flow through submerged orifice-Hydraulic Coefficients-External and internal mouthpiece.
    Notches and weirs – Rectangular, triangular, trapezoidal notches, Cippoletti weir, submerged weir, broad crested weir.

Module 4(12hours)

    Flow through pipes: Two types of flow-Laminar and Turbulent flow – Reynold's experiment, loss of head due to friction, Darcy – Weisbach equation, Other energy losses in pipes.

Hydraulic Gradient and Total Energy Lines: Flow through long pipes – Pipes in series and parallel, Siphon, Transmission of power through pipes –nozzle diameter for maximum power transmission.

Laminar Flow in circular pipes: Hagen poiseuille equation.

Turbulent flow through pipes: Establishment of flow in pipes-hydro-dynamically smooth and rough boundary, Velocity distribution for turbulent flow in pipes.

Drag and lift for immersed bodies:

Module 5(12hours)

Dimensional Analysis and Model studies: Units and dimensions of physical quantities, Dimensional Homogeneity of formulae and its application to common fluid flow problems, Dimensional Analysis-Rayleigh's method, Buckingham's method. Derivations of dimensionless parameters, Froude's, Reynold's, Webber, Mach numbers.

Hydraulic Models: Need, Hydraulic Similitude, Geometric, Kinematic, Dynamic similarity, Scale ratios of various physical quantities for Froude's and Reynold's model laws – problems, Types of models-Undistorted and Distorted models, Scale effects in models, Spillway models and Ship models.

References

1. Streeter V. L., Fluid Mechanics, Mc Graw Hill, International Students Edition.
2. Dr. P. N. Modi & Dr. S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House Delhi.
3. Jagdishlal, Fluid Mechanics & Hydraulics, Metropolitan Book Co., Delhi.
4. R. J. Garde and A. G. Mirajoaker, Engineering Fluid Mechanics, Nem Chand & Bross., Roorkee.
5. Dr.D S Kumar,S K. "Fluid Mechanics and Fluid power Engineering", Kataria& Sons,NewDelhi
6. Dr. R.K Bansal,A Text book of Fluid mechanics and Hydraulic machines, Laxmi Publications
7. Douglas,"Fluid mechanics" 4/e Pearson Education.
8. K Subramanya, Fluid Mechanics&Hydraulic Machines, Tata Mc Graw Hill, Education Private Limited NewDelhi
9. S Ramamrutham"Hydraulics Fluid Mechanics and Fluid Machines", Dhanpat Rai Publishing Company.

CE010 304: MECHANICS OF SOLIDS I

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective
• *To understand the strength characteristics of various structural members subjected to axial, bending, shearing and torsional loads*

Module 1(12hours)
 Simple stresses and strains: Elastic constants – relation between them – Bars of varying cross section - Deformation due to self weight – Bars of uniform strength - Temperature stresses – Composite members – equilibrium & compatibility conditions.
Compound stresses: Two dimensional problems-normal & tangential stresses on an inclined plane - principal stresses and planes-maximum shear stresses & planes – Analytical &Mohr's circle methods.

Module 2(10hours)
Bending moment and shear force: Types of supports, beams &loads - Shear force and Bending moment diagrams for various types of statically determinate beams with various load combinations – relation between load, shear force and bending moment.

Module 3(12hours)
Stresses in beams: Theory of simple bending- modulus of section – bending stress & strain distribution for cross-sections symmetrical about Y-Y axis - built up sections - Composite sections Beams of uniform strength.
Shear stresses in beams: shear stress distribution in cross-sections symmetrical about Y-Y axis.

Module 4(14hours)
Stresses due to torsion: Torsion of solid and hollow circular shafts- power transmitted - stresses due to axial thrust, bending and torsion.
Shear centre- shear flow (basic concepts only)
Springs: Close coiled and open coiled

Module 5(12hours)
Columns and struts: Short and long columns-Elastic instability-Euler's formula for long columns with various end conditions – effective length - slenderness ratio-limitations - Rankine's formula
Combined bending and direct stresses in short columns
Pressure vessels: Thin and thick cylinders-Lame's equation (derivation not required)-stresses in thick cylinders due to internal pressure.

References

1. Timoshenko.S.P, Strength of Materials, Part-1, D. Van Nostrand company, Inc. Newyork.
2. Nag&Chanda, Fundamentals of Strength of Materials, Wiley India Pvt. Ltd.
3. Bansal R.K., Strength of Materials, Lakshmi Publications, New Delhi.

4. Bhavikatti S.S , Strength of Materials, Vikas Publishing House (P) Ltd.
5. Sadhu Singh, Strength of Materials, Khanna Publishers
6. D.S. Prakash Rao, Strength of Materials, Vol. I, University Press (India) Ltd.
7. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Delhi.
8. Punmia B.C, Strength of Materials and Mechanics of structures, Vol.1, Lakshmi Publications, New Delhi.
9. Vazirani V.N., Ratwani N. M., Analysis of Structures, Vol.1, Khanna Publishers, New Delhi.
10. Kazimi S.M.A., Solid Mechanics, Tata Mc Graw Hill.
11. Singh, Mechanics of Solids, , Prentice Hall of India, New Delhi.
12. Arthur Morley, Strength of Materials, ELBS, Longman' s Green& Company.
13. T.S.Thandavamoorthy,Analysis of Structures Strength and Behaviour,Oxford University Press,Chennai.

CE010 305   SURVEYING – I

Teaching Scheme   **Credits : 4**
3 hour lecture and 1hour tutorial per week

Objective
To ensure that the student develops knowledge of the basic and conventional surveying instruments, principles behind them, working of the instruments, plotting of the area from the field measurements, determination of the area and the theory behind curves.

Module 1 (12hours)

Compass surveying – Prismatic compass – surveyor's compass – bearings – systems and conversions – local attraction – Magnetic declination – dip – traversing –latitude and departure - omitted measurements – errors in compass surveying

Plane table surveying – Accessories - Different methods – radiation, intersection, resection and traversing – two and three point problems and their solutions – advantages and disadvantages - errors

Module 2 (12hours)

Levelling: levels and staves – spirit levelling – bench marks – temporary and permanent adjustments – booking - methods of reduction of levels – arithmetic checks-differential, fly, check and profile leveling - cross sectioning – curvature and refraction – difficulties in leveling - reciprocal levelling – errors in leveling – sensitiveness of bubble tube.
Contouring – characteristics and uses of contours – Locating contours- plotting.

Module 3 (13hours)

Theodolite Surveying: Transit theodolite – vernier, micrometer and micro-optic theodolites – description and uses – fundamental lines of a transit theodolite – temporary and permanent adjustments – horizontal angle – reiteration and repetition methods– booking. Vertical angle measurements.
Traversing: Methods of traversing – loose needle and fast needle methods **-** plotting – closing error - adjustment of closing error by graphical and analytical methods – Bowditch's rule-conditions of closure – closing error and distribution – Gales traverse table.
Tacheometric surveying: - General principles Stadia method – distance and elevation formulae for staff held vertical – Instruments constants – analytic lens – tangential method – use of subtense bar.

Module 4 (10hours)

Areas and volumes Areas – by latitude and departure - meridian distance method – double meridian distance method – co-ordinate method – trapezoidal and Simpson's method – area by planimeter. Volume – trapezoidal and prismoidal rule. Volume from contours. - Capacity of reservoirs – Mass haul curve.

Module 5 (13hours)

Curves: Elements of a simple curve – setting out simple curve by chain and tape methods – Rankine's method – two theodolite method – compound and reverse curve (parallel tangents only) – transition curves – different kinds – functions and requirements – setting out the combined curve by theodolite – elements of vertical curve.

References

1. Dr. B. C. Punmia, Surveying Vol. I & II, Laxmi Publications (P) LTD, New Delhi.
2. T.P. Kanetkar & Kulkarni, Surveying and leveling Vol. I&II A.V.G.Publications, Pune.
3. S.K. Duggal – Surveying Vol I & II Tata Mc Graw Hill Ltd, 2006.
4. Dr. K. R. Arora, Surveying Vol. I, Standard Book House New Delhi.
5. C. Venkatramaiah, Text Book of Surveying, Universities Press (India) LTD. Hyderabad.
6. S.K.Roy, Fundamental of Surveying, Prentice Hall of India, New Delhi.
7. S.K. Hussain & M.S. Nagaraj, Surveying, S.Chand & Company Limited.
8. B.N. Basak – Surveying.
9. Alak De, Plane Surveying, S.Chand &Co.

CE010 306 ENGINEERING GEOLOGY

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objectives
To make the students familiar with physical and structural geology as well as the basics of mineralogy and petrology which help them to plan accordingly for the construction of Civil engineering structures.

Module 1 (10Hrs)
Introduction: Various branches of geology - Relevance of Geology in Engineering. Geologic time scale.
Physical Geology: Geomorphic processes-Rock weathering-Formation of soils, soil profiles-soils of India – Geologic work and engineering significance of rivers and oceans.

Module 2(10Hrs)
Dynamic Geology: Interior constitution of the earth-Various methods to study the interior-crust, mantle, core-lithosphere-asthenosphere-major discontinuities-Moho, Guttenberg, Lehmann- composition of different layers-sima & sial.
Plate tectonics: Lithospheric plates-diverging, converging and transform boundaries-their characteristic features-midoceanic ridge, benioff zone and transform faults-significance of plate tectonic concept.
Earthquake: Elastic rebound theory-types of seismic waves-cause of earthquake intensity and magnitude of earthquake-Locating epicentre and hypocenter-effect of earthquake-distribution of earthquake-earthquake resistant structures.

Module 3(14Hrs)
Mineralogy: Definition and classification-important physical properties of minerals-colour, streak, lusture, transperancy, cleavage, fracture, hardness, form, specific gravity and magnetism. Study of the diagnostic physical properties and chemical composition of the following rock forming minerals: 1.Quartz, 2.Feldspar, 3.Hypersthene, 4.Auguite, 5. Hornblende, 6. Biotite, 7.Muscovite, 8.Olivine, 9.Garnet, 10.Fluorite, 11.Tourmaline, 12.Calcite, 13.Kyanite, 14. Kaolin, 15. Serpentine.
Petrology: Definition and classification-important structures and textures of igneous sedimentary and metamorphic rocks-diagnostic texture, mineralogy, engineering properties and uses of following rocks:
Igneous rocks: 1. Granite, 2. Syenite, 3. Diorite, 4. Gabbro, 5. Peridotite, 6.Dolerite, 7.Basalt 8.Pegmatite.
Sedimentary rocks: 1. Conglomerate, 2. Breccia, 3. Sandstone, 4. Limestone, 5. shale.Metamorphic rocks: 1. Gneiss, 2. Schist, 3. Slate, 4. Marble, 5. Quartzite, 6. Mylonite, 7. Pseudotachyllite.
Special Indian rock types: 1. Charnockite, 2. Khondalite, 3. Laterite.

Module 4(14Hrs)
Structural Geology: Definition-outcrop-stratification-dip and strike. Folds-definition-parts of fold-classification-recognition of folds in the field- Faults-definition-parts of a fault-classification-recognition in the field-effects of faulting and subsequent erosion on outcrops. Joints-definition-classification. Unconformites-definition-classification recognition in the field. Effects of all the above described structures in the major engineering projects like reservoirs, dams, tunnels and other important structures.

Module 5(12 Hrs)
Engineering Geology: Mass movement of earth materials-Landslides-definition, classification, causes of land slides and their corrections-Geological considerations in the selection of sites for reservoirs and dams. Geological considerations in Tunnel constructions and mountain roads-rocks as building materials.
Hydrogeology: Groundwater table-abundance and advantages-aquifer-acquiclude-acquifuge-artesian conditions and artesian wells-cone of depression–perched water table.
Recommended field work: Field trip to quarries or geologically significant places to learn - in site character of rocks in quarries/outcrops-measuring strike and dip of a formation-tracing of outcrops.

References
1. Arthur Holmes, Physical geology, Thomas Nelson.
2. Parbin Singh, Engineering & general geology, K.Katria & sons, New Delhi.
3. HH.Read, Rutleys elements of mineralogy, George Allen & Unwin Ltd, London.
4. G.W.Tyrell, Principles of petrology, B.I. Publications, Bombay.
5. M.P.Billings, Strucutural geology, Aisa publishing house, New Delhi.
6. Krynine&Judd, Engineering geology & geotechniques, Tata McGraw hill, New Delhi.
7. David Keith Todd, Groundwater hydrology, John Wiley & sons, New York.

CE010 307 MATERIAL TESTING LABORATORY - I

Teaching scheme   **Credits: 2**
3 hours practical per week

Objective:
To study properties of various materials

List of Experiments

1. Tests on springs (open and close coiled)
2. Bending Test on Wooden Beams using U. T. M.
3. Verification of Clerk. Maxwell's Law of reciprocal deflection and
    Determination of Youngs modulus'E 'for steel.
4. Torsion Pendulum (M.S. wires. Aluminum wires and brass wires)
5. Tension test using U. T. M. on M. S. Rod, torsteel and High Tensile steel.
6. Torsion Test on M. S, Road
7. Shear Test on M.S. Rod.
8. Fatigue Test
9. Impact Test (Izod and Charpy)
10. Hardness Test (Brinell, Vicker's and Rebound)
11. Strut Test.

Note
All tests should be done as per relevant BIS.

References
1. Timoshenko.S.P, Strength of Materials, Part-1, D.Van Nostrand company,
    Inc.Newyork.
2. Bansal R.K., Strength of Materials, Lakshmi Publications, New Delhi.
3. Bhavikatti S.S , Strength of Materials, Vikas Publishing House (P) Ltd.
4. D.S. Prakash Rao, Strength of Materials, Vol. I, University Press (India) Ltd.
5. Popov E.P., Engineering Mechanics of solids, Prentice Hall of India, New Deihi.
6. Punmia B.C, Strength of Materials and Mechanics of structures, Vol.1, Lakshmi
    Publications, New Delhi.

CE010 308 SURVEYING PRACTICAL– I

Teaching Scheme   **Credits :2**
3 hours practical per weak

Objective: *To impart training in surveying using Chain, Compass, Plane table ,*
Level and theodolite.

List of Exercises

1. Compass Survey- Traversing with compass and plotting
2. Plane table Survey- Solving Two Point Problem
3. Plane table Survey -Solving Three Point Problem
4. Leveling -Fly leveling- plane of collimation method
5. Leveling- Fly leveling- rise and fall method
6. Leveling -Longitudinal and cross sectioning
7. Leveling -Contour surveying
8. Study of Minor instruments: Planimeter, pantagraph, clinometer, hand levels, Quick setting level, Cylon Ghat Tracer, sextent
9. Theodolite : study of instrument, temporary adjustments, measurement of horizontal and vertical angles.
10. Theodolite surveying - horizontal angle by repetition & reiteration methods.
11. Heights and distances by solution of triangles

References
1. Dr.B.C.Punmia, Surveying Vol. I & II, Laxmi Publications (P) LTD, New Delhi.
2. T.P.Kanetkar & Kulkarni, Surveying and leveling Vol. I&II A.V.G.Publications, Pune.
3. Dr.K.R.Arora, Surveying Vol. I, Standard Book House New Delhi.
4. S. K. Duggal, Surveying Vol I, Mc Graw Hill,

EN010 401 Engineering Mathematics III

(Common to all branches)

Teaching scheme   **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Apply standard methods of mathematical &statistical analysis*

Module 1   (12 hours)
Fourier series: Dirichlet conditions – Fourier series with period 2π and 2l – Half range sine and cosine series – Harmonic Analysis – r.m.s Value.

Module 2   (12 hours)
Fourier Transform : Statement of Fourier integral theorem – Fourier transforms – derivative of transforms- convolution theorem (no proof) – Parsevals identity.

Module 3 (12 hours)
Partial differential equations : Formation by eliminating arbitrary constants and arbitrary functions – solution of Lagrange's equation – Charpits method –solution of Homogeneous partial differential equations with constant coefficients.

Module 4 (12 hours)
Probability distribution : Concept of random variable , probability distribution – Bernoulli's trial – Discrete distribution – Binomial distribution – its mean and variance- fitting of Binominal distribution – Poisson distribution as a limiting case of Binominal distribution – its mean and variance – fitting of Poisson distribution – continuous distribution- Uniform distribution – exponential distribution – its mean and variance – Normal distribution – Standard normal curve- its properties.

Module 5 (12 hours)
Testing of hypothesis : Populations and Samples – Hypothesis – level of significance – type I and type II error – Large samples tests – test of significance for single proportion, difference of proportion, single mean, difference of mean – chi –square test for variance- F test for equality of variances for small samples.

References

1.   Bali& Iyengar – A text books of Engg. Mathematics – Laxmi Publications Ltd.
2.   M.K. Venkataraman – Engg. Mathematics vol II 3rd year part A & B – National Publishing Co.
3.   I.N. Sneddon – Elements of partial differential equations – Mc Graw Hill
4.   B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
5.   Richard A Johnson – Miller Fread's probability & Statistics for Engineers- Pearson/ PHI
6.   T. Veerarajan – Engg. Mathematics – Mc Graw Hill
7.   G. Haribaskaran – Probability, Queueing theory and reliability Engg. – Laxmi Publications
8.   V. Sundarapandian - probability ,Statistics and Queueing theory – PHI
9.   H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International
10. A.K.Mukhopadhyay-Mathematical Methods For Engineers and Physicists-I.K.International

CE010 402 CONSTRUCTION ENGINEERING AND MANAGEMENT

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective:
 *Imparting fundamental knowledge in network scheduling techniques, details of execution
of works, principles of functional planning of buildings, mechanization in construction,
project cost analysis and industrial relations*

Module 1 (12 Hours)
Fresh concrete – Workability-factors affecting-measurement of workability-different
tests for workability-segregation-bleeding-process of manufacture of concrete-batching-
mixing-transportation-compaction-curing methods-admixtures in concrete-special
concretes
Joints – Construction joints – expansion joints – contraction joints – sliding joints
– joints in water retaining structures etc.
Scaffolding and Formwork (elementary concepts only).
Flooring – different types – Mosaic – marble – granite – roofing – pitched and
flat roofs – domes and folded plate roofs
Damp prevention – Causes – Material used – Damp proofing of floors – walls –
roofs.
Finished works – plastering, painting – white washing – distempering –
application of Snowcem – Concrete repairs-construction and constructed
facilities.

Module 2 (12 Hours)
Functional planning of buildings – general principles of site plan – principles of
functional planning – orientation of buildings – shading principles.
Modern construction materials – Intelligent buildings – building automation.
Construction management –
Mechanisation in construction – earth moving,handling, pneumatic and hoisting
equipment – pile driving equipment – Earthwork computation – mass diagram – soil
compaction & stabilization – owning and operating works of construction equipment.

Module 3 (12 Hours)
Introduction to job planning and Management: Bar charts and mile stone
charts - work breakdown structure - C P M and PERT networks - Network and
time estimates - Earliest expected time - Forward pass and backward pass - Time
estimates - related problems.

Module 4 (12 Hours)
Project costs analysis: Cost Vs Time curve - optimum duration- related problems
- updating, resource allocation - resource smoothing – resource leveling -
Network compression - Compression limited by crashing - float- parallel critical
paths - crashed critical paths – most economical solution.

Module 5 (12 Hours)
Industrial Relations: Payment of wages Act - Minimum wages Act - Employees
State Insurance Act –Workers participation in management – labour welfare and
social security – Industrial safety and welfare provision – role of state in labour
welfare – role of labour welfare officers social security principles and practice.

References
1. M. S. Shetty, Concrete technology, S.Chand & Co.
2. S. P.Arora, Building construction, Dhanpat Rai & Sons, New Delhi.
3. Dr.Mahesh Varma, Construction Equipment and its Planning and Application,
Metropolitan Book Company.
4. R.L.Peurifoy, W.B.Ledbetter, Construction Planning, Equipment, and methods,
Tata Mc Graw Hill.
5. Chitkara, Construction Project Management Planning scheduling and control Mc
GrawHill
6. B.L.Gupta, Amit Gupta, Construction Management and Accounts, Standard
publishers and Distributors.
7 James.D.Steevens, Techniques for Construction Network Sheduling, McGraw
Hill.
8. S.C.Sharma, Management of Systems, Khanna Publishers.
9. L. S. Srinath, PERT and CPM Principles and Applications, East – West Press.
10. Subir K. Sarkar,Subhajit Sarasswati ,Construction Technolgy, Oxford University
press.
11. A.R. Santhakumar, Concrete Technology, Oxford university Press.

CE010 403: MECHANICS OF SOLIDS- II

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objectives:
• *To understand the basic strength and energy theorems of Structural Mechanics and its applications*
• *To study deformations of bodies caused by externally applied forces and the internal effects produced due to moving loads.*
.
Module 1 (12 hours)
Deflection of determinate beams: Differential equation of the elastic curve- slope
& deflection of beams by Double integration method (concept only)-Macaulay's method
- Conjugate beam method
 Deflection due to shear (concept only).

Module 2 (12 hours)
Energy Theorems: Strain energy due to axial load(gradual, sudden & impact), bending, shear and torsion-principle of super position- Betti' s theorem -Maxwell' s reciprocal theorem-principle of virtual work(deformable bodies)-Castigliano' s first theorem-deflection of statically determinate beams & pin jointed frames by strain energy, virtual work and unit load methods

Module 3 (12 hours)
Moving loads and influence lines: effect of moving loads-influence lines for reaction, shear force and bending moment for determinate beams
Absolute maximum bending moment (basic concept only).

Module 4 (12 hours)
Arches: Theoretical arch-Eddy' s theorem- analysis of three hinged arches –support reactions-normal thrust-radial shear
Cables and suspension bridges: General cable theorem-analysis of cables under concentrated and uniformly distributed loads-anchor cables
Suspension bridges with stiffening girders(basic concepts only).

Module 5 (12 hours)
Theories of Elastic Failure: Maximum principal stress theory-maximum shear stress theory - maximum principal strain theory – Mohr's theory. Principle of stationary and minimum potential energy, Castigliano's theorems (theory only)
Unsymmetrical bending: Product of inertia-principal axes (basic concepts only)
References:
1.Devdas Menon, Structural Analysis, Vol.1, Narosa, Chennai.
2. Bhavikatti S.S , Structural Analysis Vol. I, Vikas Publishing House (P) Ltd.
3. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.1996.
4. C. K. Wang, Intermediate Structural Analysis, Tata McGraw Hill Education Private
   Ltd.
5. Smith J.C. Structural Analysis, Macmillian Pub.Co.1985.

6. Rajesekharan &Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2001.
7. Wang C.K.& Solomon C.G., Introductory Structural Analysis, McGraw Hill.1968.
8. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.
9. Seeli F.B.& Smith J.P., Advanced Mechanics of Materials, John Wiley &Sons, 1993.
10. Norris & Wilbur, Elementary Structural Analysis, McGraw Hill.
11. Junarker S.R., Mechanics of Structures, Vol. II, Charorbar Book Stall.
12. Timoshenko S.P, Young D.H., Theory of structures, McGraw Hill
13. Thadani B.N, Desai J.P, Structural mechanics, Weinall Book Corporation.
14. Punmia B.C., Strength of materials and theory of structures, Vol.II, Laxmi publications.

CE010 404   OPEN CHANNEL FLOW AND HYDRAULIC MACHINES

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objectives:

- *The problems that man encountered in the field of water supply, irrigation, navigation and water power resulted in the development of fluid mechanics*
- *It enables us to understand the interesting phenomenon in nature and it empowers us to design and to create variety of fluid flow equipment for the benefit of mankind*

Module 1 (12 Hours)
　　Flow in open Channel – Types of flow, – Velocity distribution in open channels, Uniform flow in open channels– Chezy's , Manning's and Kutter's formula, Most economical cross sections – computation of uniform flow- conveyance - Normal depth. Energy in open channel flow- specific energy. Momentum in open channel flow-specific force , Critical flow and its computation-critical flow in rectangular channels Application of specific energy and discharge diagrams to channel transitions,

Module 2 (12 Hours)
　　Measurent of flow in open channels-mean velocity-pitot tube,current meter,floats. Discharge in flumes and rivers
　　Gradually varied flow- Dynamic Equation for gradually varied flow- in wide rectangular channels-different forms of the dynamic equation, channel bottom slopes- Study of surface profiles and its Characteristics in prismatic channels, backwater computation by direct step method.

Module 3 (10 Hours)
　　Rapidly varied flow, hydraulic jump – initial and sequent depths, non-dimensional equation, Practical application of hydraulic jump, Types of jump in horizontal floor, Basic characteristics of the jump, Energy loss, efficiency, height of jump, jump as energy dissipater, stilling basins, Location of hydraulic jump.

Module 4 (14 Hours)
　　Hydraulic Machines – Impulse momentum principle, Impact of jet, Force of jet on stationary and moving plates –
　　Turbines – Classification, velocity triangle for Pelton, Francis, Kaplan turbines, Specific speed, selection of turbines, draft tube – types,

Module 5 (12 Hours)
　　Centrifugal Pumps – Types, Velocity triangle for pumps-Work done- Head of pump, Losses and efficiency, Minimum starting speed, Specific speed, Multistage pump, Pumps in parallel.

Positive displacement pumps – working principle, types of reciprocating pumps, work done- effect of acceleration and frictional resistance, slip and coefficient of discharge. Indicator diagram, separation in suction and delivery pipes. Air vessel – rate of flow into and from air vessel.

References

1. Ven Te Chow, Open Channel Hydraulics, Mc Graw Hill Ltd.
2. K. Subrahmanya, Flow in open channel vol.1, Tata McGraw Hill, New Delhi
3. Dr. P. N. Modi & Dr. S. M. Seth, Hydraulics & Fluid Mechanics, Standard Book House, Delhi.
4. Jagadheesh Lal, Hydraulic Machines, Metropolitian Book Co., New Delhi.
5. Dr. R.K Bansal,A Text book of Fluid mechanics and Hydraulic machines,Laxmi Publications
6. K.G Rangaraju, Flow through openchannel Tata Mc Graw Hill
7 . Shivkumar, "Fluid Mechanics& Fluid Machines Basic concepts& Principles; Ane Books Pvt. Ltd

CE010 405   SURVEYING - II

Teaching Scheme   **Credits : 4**

3 hour lecture and 1hour tutorial per week

Objective

To impart knowledge in triangulation, aerial photogrammetry and modern Electro Magnetic Distance Measurement instruments.

Module 1 (12 hours)

Triangulation: triangulation figures – classification of triangulation systems – selection of triangulation stations – intervisibility and heights of stations – station marks – signals and towers – base line – choice – measurement of base lines – instrument- extension of base- satellite stations – need, reduction to centre.

Module 2 (12 hours)

Theory of errors and triangulation Adjustments: Kinds of error – laws of weights – principles of least squares – determination of most probable value of quantities – probable error – distribution of error to the field measurements – normal equation – Method of correlatives – Adjustment of simple triangulation figures.

Module 3 (10 hours)

Hydrographic surveying –Equipment – Methods of locating soundings – reduction and plotting of soundings – use of sextants and station pointer.

Electro Magnetic Distance Measurement (EDM): - Principle of EDM – Types of EDM instruments – Distomat – Total Station – principles – procedure and surveying using Total Station – data retrieval and processing.

Module 4 (12 hours)

Terrestrial photogrammetry – General principles – photo theodolite – horizontal position of a point from photogrammetric measurements – elevation of a point – determination of focal length of lens. Aerial photogrammetry – aerial camera – scale of vertical photograph – relief displacement on a vertical photograph – principle of parallax – stereoscopic pairs – flight planning – radial line method – flying height and overlaps – remote sensing – concepts of remote sensing – ideal remote sensing system.

Module 5 (14 hours)

Geodesy – shape of earth – effects of curvature – spherical excess – convergence of meridians.

Field Astronomy: - Definitions – celestial sphere – astronomical triangle - co-ordinate systems. Determination of time, azimuth, latitude and longitude.

References:

1. T. P. Kanetkar and Kulkarni, Surveying and leveling Vol. II, A.V.G. Publications, Pune.

2. B. C. Punmia, Surveying and leveling Vol. II, Laxmi Publications (P) LTD, New Delhi.
3. Thoms M. Lillerand, Remote sensing and image interpretation, John Wiley & Sons, Inc. New York.
4. Dr. K.R. Arora, Surveying Vol. II, Standard Book House, New Delhi.
5. Alak De, Plane Surveying, S.Chand &Co.
6. S. K. Duggal – Surveying Vol I & II Tata Mc Graw Hill Ltd, 2006.
7. R. Sathikumar, Satheesh Gopi and N. Madhu, Advanced Surveying: Total Station, GIS and remote Sensing, Pearson Education, India

CE010 406 CIVIL ENGINEERING DRAWING

Teaching scheme   **Credit -4**
4 hours drawing per week

Objectives:
To create awareness among students regarding the principles of building drawing and equip them to prepare plan , section, elevation , site plan and service plan of buildings as per Kerala Building Rules.

PART A

Detailed drawing of panelled door with wooden frame. (1 sheet).
Reinforced concrete staircase (1 sheet).
Roof truss using standard steel sections (1 sheet).
Roof lines (1 sheet).
Detailing of Mangalore pattern tiled roofing (1 Sheet).

PART B

Working drawings – Preparation of plan, section and elevation from line sketches (single and double storied buildings)(8 sheets).
Preparation of line sketches and working drawings of single storied RCC residential buildings, as per area and functional requirements.   (2 sheets)

Preparation of site plan as per Kerala Building Rules.   (1sheet)

Plumbing services-
 Layout of water supply and sanitary connections for residential buildings.(1 sheet)

Mark distribution
> **Part A - 30 marks.**
> **Part B - 70 marks.**

References:-
 1. Balagopal & T. S. Prabhu, Building drawing & detailing, Spades Publishers and distributors, Calicut.
2. Shah & Kale, Building Drawing, Tata Mc Graw Hill, New Delhi.
3. B.P.Varma, Civil Engineering drawing and House Planning, Khanna Publishers, Delhi.
4. Gurucharan Singh, Subhash Chander Sharma, Civil Engineering drawing, Standard Publishers distributors, Delhi.
5. National Building code, Kerala building byelaws.

CE010 407 SURVEYING PRACTICAL II

Teaching Scheme   **Credits: 2**

3 hours practical per week

Objective

• *To give a practical knowledge in different aspects of Theodolite Surveying & Tacheometry*

List of exercises
1. Determination of tacheometric constants
2. Heights and distances by stadia tacheometry(2classes)
3. Heights and distances by tangential tacheometry(2classes)
4. Three point problem.
5. Setting out of simple curves - angular method
6. Theodolite traversing
7. Setting out of building plans
8. Study of Total station
9. Total station – Horizontal and vertical angles, Horizontal distance, Level difference.

References :

1. Dr. B. C. Punmia, Surveying Vol. I & II, Laxmi Publications (P) LTD, New Delhi.
2. T.P. Kanetkar & Kulkarni, Surveying and leveling Vol. I&II A.V.G.Publications, Pune.
3. Dr. K. R. Arora, Surveying Vol. I, Standard Book House New Delhi.
4.. S. K. Duggal , Surveying Vol I& II, Tata Mc Graw Hill.

CE010 408(ME)   HYDRAULICS LABORATORY

Teaching scheme   **Credits: 2**

3 hours practical per week

Objectives

To impart practical knowledge in heat engines and hydraulics laboratories

PART-A (FLOW)

1. Study of taps, valves, pipe fittings, gauges, pitot tubes, watermeters and current meters.

2. Determination of metacentric height and radius of gyration of floating bodies.

3. Hydraulic coefficients of orifices and mouthpieces under constant head method and time of emptying method.

4. Calibration of venturimeter, orifice meter and watermeter.

5. Calibration of rectangular and triangular notches.

6. Determination of Darcy s and Chezy s constant for pipe flow.

7. Determination of Chezy s constant and Mannings number for open channel flow.

8. Determination of discharge coefficient for plug-sluices.

PART –B (MACHINERY)

1. Study of reciprocating pump and components-single cylinder and multicylinder, self priming pumps and centrifugal pumps.

2. Study of impulse and reaction turbines.

3. Performance characteristics of self priming pump.

4. Performance characteristics of centrifugal pump.

5. Performance characteristics of reciprocating pump

6. Performance characteristics of Pelton wheel.

7. Performance characteristics of Francis Turbine.

8. Performance characteristics of Kaplan Turbine.

References

1. Hydraulic Machines-Jagadishlal

EN010 501A   ENGINEERING MATHEMATICS IV
(Common to all branches except CS & IT)

Teaching scheme   **Credits: 4**

2 hours lecture and 2 hour tutorial per week

Objectives: *Use basic numerical techniques to solve problems and provide scientific techniques to decision making problems.*

Module 1 (12 hours)
Function of Complex variable : Analytic functions – Derivation of C.R. equations in cartision co-ordinates – harmonic and orthogonal properties – construction of analytic function given real or imaginary parts – complex potential – conformal mapping of z^2 , $\frac{1}{z}$ - Bilinear transformation – cross ratio – invariant property (no proof) – simple problems.

Module 2 (12 hours)
Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Taylor's series- Laurent's series – Zeros and singularities – types of singularities – Residues – Residue theorem – evaluation of real integrals in unit circle – contour integral in semi circle when poles lie on imaginary axis.

Module 3   (10 hours)
Numerical solution of algebraic and transcendental equations: Successive bisection method – Regula –falsi method – Newton –Raphson method - Secant method – solution of system of linear equation by Gauss – Seidel method**.**

Module 4 (10 hours)
Numerical solution of Ordinary differential equations: Taylor's series method – Euler's method – modified Euler's method – Runge – Kutta method (IV order) - Milnes predictor – corrector method.

Module 5 (16 hours)
Linear programming problem: Definition of L.P.P., solution, optimal solution, degenerate solution – graphical solution –solution using simplex method (non degenerate case only) Big -M method – Duality in L.P.P. – Transportation problem –Balanced T.P. – initial solution using Vogel's approximation method - modi method (non degenerate case only)

References

1. B.V. Ramana – Higher Engg. Mathematics – Mc Graw Hill
2. M.R.Spicgel , S.Lipschutz , John J. Schiller, D.Spellman – Complex variables, schanm's outline series - Mc Graw Hill
3. S.Bathul – text book of Engg.Mathematics – Special functions and complex variables – PHI
4. B.S. Grewal – Numerical methods in Engg. and science - Khanna Publishers

5. Dr.M.K Venkataraman- Numerical methods in science and Engg -National publishing co
6. S.S Sastry - Introductory methods of Numerical Analysis -PHI
7. P.K.Gupta and D.S. Hira – Operations Research – S.Chand
8. Panneer Selvam– Operations Research – PHI
9. H.C.Taneja – Advanced Engg. Mathematics Vol II – I.K.International

CE010 502 COMPUTER PROGRAMMING

Teaching Scheme **Credit: 4**
3 hours lecture and 1hour tutorial per week**.**

Objective:
To provide a strong foundation in the basics of C-Programming so that students can develop the ability to design software's.

Module I (15 Hours)
Introduction to C: The C character set- identifiers and keywords- data types-user defined data types-constants and variables-declarations- operators-expressions-statements-library input-output functions
Control statements: if, if-else, switch, -conditional and comma operators.

Module II (15 Hours)
Iterative statements: 'while', 'do-while', for 'statements-nested loops, break and continue statements.
Functions: Declarations, definition and access-passing arguments to a function – pass by value and pass by reference-recursion.
Storage classes: automatic variables-external variables-register variables-scope and lifetime of variables-macros

Module III (12 Hours)
Arrays: Single dimensional arrays-multidimensional arrays-definition-initializing arrays-passing arrays to a function- matrix operations-addition, transpose and multiplication. Pointers-declaration-operations.
Strings: definition –string handling function-comparison, concatenation and sorting of strings

Module IV (10 Hours)
Structures and union: definition –initialization-accessing structure members-array of structures-passing structure to a function –sorting of structures –binary files-reading and writing of data blocks-union.
Dynamic memory allocation - self referential structures - basic concepts of linked lists.

Module V (8 Hours)
Files :File pointers-data files-opening and closing-reading and writing-appending-error handling function-handling data in blocks-command line arguments.

References
1.B.S. Gotterfield Theory and Problems of Programming with C.TMH
2. Balaguruswamy, Programming in C, Tata Mc Graw Hill.
3. Kern Ingham , Ritchie, The C programming language, Prentice Hall.
4. Byron S Gottfried, Programming with C, Tata Mc Graw Hill.

5. Y. Kenetker, Let us C, BPB Publications.
6. V. Rajaraman, Programming with C.
7. Y. Kenetker, Exploring C, BPB Publications.

CE010 503   DESIGN OF CONCRETE STRUCTURES – I

Teaching Scheme   **Credit: 4**
2 hours lecture and 2 hours tutorial per week**.**

Objective
* *To provide the students with the knowledge of behaviour of reinforced concrete structural elements in flexure, shear, compression and tension and to enable them to design such elements.*

Module 1 (12 hours)
   Working stress method: Introduction- permissible stresses-factor of safety – behaviour of R.C.C beams –assumptions-under reinforced –over reinforced and balanced sections. Theory of singly and doubly reinforced beams.

Module 2   (12 hours)
   Limit state method: Concepts-assumptions –characteristic strength and load partial safety factors-limit states-limit state of collapse –limit state of serviceability. Theory of singly and doubly reinforced rectangular sections in flexure-design of simply supported and flanged beams.

Module 3   (15 hours)
   Behaviour and design of one way and two way slabs-Continuous slabs-analysis using method recommended by BIS -arrangements of reinforcement in slabs. Design of flat slab (Concept only).

Module 4   (8 hours)
   Design of columns: Limit state method- I S specifications-design of columns with lateral and helical reinforcement-members subjected to combined axial load and bending.

Module 5   (13 hours)
   Design of footings-Isolated footing with axial and eccentric loading-combined footing. Stair cases-introduction to different types-design of simply supported flights-cantilever steps.

   Note: Sketches only required for reinforcement details. Detailed drawing in drawing sheets not required.

References

   1. Relevant IS codes. (I.S 456, I.S 875,SP 16)
   2. Park R and Pauloy T, Reinforced concrete structures, John Wiely & sons Inc.
   3. Purushothaman P, Reinforced concrete structural elements-Behaviour, Analysis and Design, Tata McGraw Hill publishing company Ltd.
   4. Unnikrishna Pillai S. & D.Menon, Reinforced concrete design, Tata McGraw Hill

Publishing company Ltd.
5. Mallick S.K., Reinforced concrete, Oxford & IBH Publishing company.
6. Varghese P.C., Limit state design of Reinforced concrete, Printice Hall of India Pvt Ltd.
7. Ashok .K. Jain, Reinforced concrete- Limit state design, New Chand & Bose.
8. S.S Bhavikatti, Design of Reinforced concrete structures, I.K.International Publishing house Pvt.Ltd

CE010 504 GEOTECHNICAL ENGINEERING – I

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective:
Geotechnical Engineering is one of the important disciplines of Civil Engineering involving the study of behaviour and engineering properties of soil.
The objective of the course is to present different laws and principles of Soil Mechanics so that the strength and settlement of the foundation soil can be evaluated.

Module 1 (15 Hours)
      Soil formation and soil types: Residual soil and transported soil-Soil structure-Basic structural units of clay minerals. Simple soil properties: three phase systems - void ratio - porosity - degree of saturation - moisture content - specific gravity - unit weight relationships.
      Laboratory and field identification of soils: Determination of water content, specific gravity, determination of field density by core cutter and sand replacement method, grain size analysis by sieve, hydrometer analysis - Atterberg limits and indices - field identification of soils.
Classification of soils: Principles of classification - I. S. classification - plasticity chart.

Module 2 (13 Hours)
      Permeability of soils: Darcy's law - factors affecting - constant head and falling head test - permeability of stratified deposits. soil- water system - classification of soil water - capillarity of soils - principles of effective stress.
      Seepage of soils: seepage pressure, critical hydraulic gradient - quick sand condition - flownet diagram for isotropic and anisotropic soils
.

Module 3 (10 Hours)
      Shear strength: Shear strength parameters - Mohr's circle – Mohr Coulomb strength theory -direct, triaxial, unconfined and vane shear tests- Drainage conditions - UU, CD and CD tests - choice of test conditions for field problems - measurement of pore pressure-critical void ratio and liquefaction. - Activity ,sensitivity and thixotropy

Module 4 (12 Hours)
      Compaction: Objects of compaction - proctor test and modified proctor test - concept of OMC and Max. dry density - Zero air void line - factors affecting compaction - effect of compaction on soil properties - field methods-.of compaction - control of compaction.
      Stability of slopes: types of failures of soil slopes - Analysis of finite slopes only-Swedish circle method -   = 0 analysis and c -   analysis. -Taylor's stability number and stability charts
.

Module 5 (10 Hours)

Compressibility and consolidation of soils: void ratio - pressure relationship - concept of coefficient of compressibility - coefficient of volume change and compression index - normally loaded and pre loaded deposits - determination of preconsolidation pressure - Terzaghi's theory of one dimensional consolidation - time rate of consolidation - time factor - degree of consolidation - square root time and log time - fitting methods - coefficient of consolidation - calculation of void ratio - height of solids methods and change in void ratio method - settlement analysis.

References

1. Murthy V. N.S, Soil Mechanics and Foundation Engineering, Nai Sarak, Delhi.
2. Gopal Ranjan and A .S .R .Rao, Basic and Applied Soil Mechanics, New Age International Publishers.
3. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxshmi Publications, New Delhi.
4. Arora K. R., Soil Mechanics and Foundation Engineering, Standard Publishers, Distributors.
5. V. Narasimha Rao and Venkatramaiah, Numerical Problems, Examples and Objective Questions in Geotechnical Engineering, Orient LongMan Publishers.
6. Lambe & Whitman, Soil Mechanics, John Wiely Publications
7. S. K. Garg, Soil Mechanics and Foundation Engineering, Khanna Publishers.

CE010 505 QUANTITY SURVEYING AND VALUATION

Teaching Scheme   **Credit: 4**
3 hours lecture and 1hour tutorial per week**.**

Objective
To make the students proficient in preparing the rates and thereby adapting them to estimate the entire project.

Module 1 & 2 (26 Hours.)
        Purpose of estimates- different methods-Preparation of detailed estimates and abstracts for RCC Single storey buildings - R C. Footings, Columns – T- Beams. Preparation of bar bending schedule for R. C. works such as beams and slabs.

Module 3 (12 hours.)
        Preparation of specification for common materials of construction and its items of works with reference to IS specifications. Cost of materials at source - different types of conveyance and rates - head loads - preparation of conveyance statement- cost of materials at site.

Module 4 (12 hours)
        Analysis of rates for earth works, mortars, RCC Works, plastering, brick works, stone works, laterite work, Pointing, form work, flooring - different types, wood works - reinforcement works.

Module 5 (10 hours)
        Valuation - explanation of terms - material value, rate, years purchase - freehold and lease hold purchase - depreciation - methods of calculating depreciation - straight line method - constant percentage method, sinking fund method - and quantity survey method. Methods of valuation of land - comparative method - abstractive method. Methods of valuation of property - rental method - direct comparison with capital cost - valuation based on profit - valuation based on cost - development method - depreciation method.

References

      1. Schedule of rates, KPWD
      2. PWD Data Book
      3. Dutta, Estimating and costing,S Dutta & Company, Lucknow
      4. Rangawala S.C., Estimating & costing, Charator Anand, Delhi
      5. I.S: 1200- 1968 - Methods of measurements of building and civil engineering

University Examination Pattern

Module1&2

    Quantity calculation-4 items   **4x10 marks**

Module 3

    Specification of any 4 items
    or conveyance statement as per PW D norms and   **4x5 marks**
      cost of any 6 materials at source

Module 4

    Rate analysis of any two items   **2x10 marks**

Module 5

    Problem connected with depreciation of cost   **2x10 marks**

Note:-choice should be given to questions from all the 5 modules

CE 010 506 STRUCTURAL ANALYSIS l

Teaching scheme: **Credits: 4**
3hour lecture and 1 hour tutorial per week

Objective:
To study the force and displacement methods of structural analysis of indeterminate structures , the influence line diagrams and an introduction to Finite Element Method.

Module 1 (12 hours)
 Indeterminate structures- force and displacement methods of structural analysis.
 Force method of analysis of indeterminate structures - static indeterminacy
 Method of consistent deformation, Clapyron' s theorem of three moments- analysis of fixed and continuous beams

Module 2 (12 hours)
 Displacement method of analysis: Kinematic indeterminacy
 Slope deflection method-fundamental equations-analysis of continuous beams & portal frames (with sway and without sway)
 Moment distribution method - analysis of continuous beams & portal frames (with sway and without sway).

Module 3 (14 hours)
 Matrix methods: Stiffness method-stiffness-equilibrium equation
 Direct stiffness method - structure stiffness matrix-assembly of structure stiffness matrix from element stiffness matrix-equivalent joint load – incorporation of boundary conditions –analysis of beams and pin-jointed frames.

Module 4 (10 hours)
 Flexibility method: Flexibility –compatibility equation-flexibility influence coefficients – force transformation matrix-flexibility matrix-analysis of beams & frames (rigid and pin-jointed).

Module 5 (12hours)
 Finite element method: Introduction to FEM-Historical development-Idealization of actual structures- Boundary conditions. General procedure of FEA-Displacement approach - shape functions

References

1.Devdas Menon, Structural Analysis, Vol.1&II, Narosa, Chennai.
2. Bhavikatti S.S , Structural Analysis Vol. I, Vikas Publishing House (P) Ltd.
3. Weaver &Gere, Matrix Analysis of Structures, East West Press.
4. Moshe F. Rubinstein – Matrix Computer Analysis of Structures- Prentice Hall, 1969.
5. Meek J.L., Matrix Structural Analysis, McGraw Hill,1971.
6. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.1996.

7. Smith J.C. Structural Analysis, Macmillian Pub.Co.1985.

8. Rajesekharan & Sankarasubramanian,G., Computational Structural Mechanics, Prentice Hall of India, 2001.

9. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis, Oxford & IBH,1984.

10. Wang C.K.& Solomon C.G., Introductory Structural Analysis, McGrawHill.1968.

11. Pezemieniecki, J.S, Theory of Matrix Structural Analysis, McGraw Hill Co., 1984

12. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.

13. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley &Sons, 1993.

14. Norris & Wilbur, Elementary Structural Analysis, McGraw Hill.

15. Junarker S.R., Mechanics of Structures, Vol. II, Charorbar Book Stall.

16.O C Zienkiewicz,.Finite Element Method, fourth Edition,McGraw Hill,

17. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley &Sons.

19. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill .New Delhi, 1987.

20. S.Rajasekharan, Finite Element Analysis, Wheeler Publishing Co., &Sons.1993.

CE010 507COMPUTING TECHNIQUES LAB

Teaching Scheme   **Credit: 2**
3 hours Practical   per week.

Objective:
To make the students aware of recent application softwares and to develop programming skills in C language.

List of Experiments:

1. Familiarization of computer hardware, peripherals and network components. Study of operating systems like DOS, Windows. Linux etc. Commands for use of files and directives.
2. Familiarization with packages like MS Word, MS Excel, and power point.
3. Programming examples related to control statements, arrays, structures, functions, pointers and files in accordance with syllabus of C like,
    a. Solution of quadratic equations
    b .Preparation of conversion tables
    c. Summation of series
    d. Arrays manipulation
    e. Functions
    f. Recursive functions
    g. String manipulations
    h. Matrix operations
    i. .Preparation of mark lists of students, bills etc. using structures
    j. Input and out using files
    k. Simple programs of linked lists and command lime arguments

References

1. Balaguruswamy, Programming in C, Tata Mc Graw Hill.
2. Kern Ingham , Ritchie, The C programming language, Prentice Hall.
3. Byron S Gottfried, Programming with C, Tata Mc Graw Hill.
4. Y. Kenetker, Let us C, BPB Publications.
5. V. Rajaraman, Programming with C.

CE010 508 GEOTECHNICAL ENGINEERING LABORATORY

Teaching Scheme   **Credit:2**
3 hours practical per week**.**

Objective:
To practice   the different experiments for determination of index properties and strength of soil and to develop confidence in students to assess the suitability of soil for various construction activities

 List of Experiments:

1. Determination of specific gravity, water content and particle size distribution by hydrometer method / pipette method.
2. Determination of field density of soil by sand replacement method and core cutter method.
3. Determination of Atterberg limits.
4. Proctor's compaction tests (light and heavy).
5. Permeability tests for cohesive and cohesionless soil.
6. Direct shear test.
7. Triaxial shear test.
8. Unconfined Compression test.
9. Vane shear Test.
10. Consolidation test.
11. Study on Collection and Field Identification of Soil and Sampling Techniques.

References

1. Gopal Ranjan and A .S .R .Rao, Basic and Applied Soil Mechanics, New Age International Publishers.
2. Punmia B. C., Soil Mechanics and Foundation Engineering, Laxshmi Publications, New Delhi.
3. Arora K. R., Soil Mechanics and Foundation Engineering, Standard Publishers, Distributors.
4. V. Narasimha Rao and Venkatramaiah, Numerical Problems, Examples and Objective Questions in Geotechnical Engineering, Orient LongMan Publishers.

CE010 601 DESIGN OF STEEL STRUCTURES

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
To familiarize the fundamental aspects of structural behaviour and design of steel structures satisfying the requirements such as safety,feasibility and economy of steel structures.

Module 1 (12 hours)
Loading standards - I.S structural sections - I.S specifications –Design Philosophies- Working stress method and Limit state method - design of tension members –bolted and and welded connections - design of simple and compound beams - laterally supported and unsupported.(Design examples based on Limit state method only.)

Module 2 (12 hours)
Compression members - design of columns - short and long columns - axial and eccentric loading - built up columns-moment resisting connections - lacing and battening - column base - slab base - gusseted base.

Module 3 (15 hours)
Water tanks – rectangular and circular steel tanks – connections - analysis and design of supporting towers.

Module 4 (10 hours)
Light gauge steel structures - introduction - type of sections - local buckling - stiffened and multiple stiffened elements – Design of beams with lateral supports only.

Module 5 (11 hours)
Chimneys- types - self supporting and guyed – stresses in chimneys – design of chimney stack, breech opening, base plate, connections and foundations.(Design of self supporting chimney only.)

Note: Only Sketches required. Detailed drawing in drawing sheets not required

References

1. Relevant IS Codes. (IS 800-2007 , IS 875, IS 805, IS 801, IS 811,IS 6533 Part 1, Part 2,Steel Tables)
2. Subramanian N, Design of steel structures,Oxford University Press
3.S.S Bhavikatti, Design of steel structures, I.K.International Publishing house Pvt.Ltd.
4. Ramchandra, Design of steel structures Vol. I & II, Standard book house, Delhi.
5. S.K. Duggal, Design of steel structures ,Tata Mc Graw-Hill
6. B.C.Punmia, Design of steel structures, Laxmi publications.

CE010 602 GEOTECHNICAL ENGINEERING – II

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
Civil Engineer has many diverse and important encounters with soil. The knowledge of soil Mechanics is helpful in the design of foundations, earth retaining structures ,pavements ,excavations, embankments and dams.
*The objective of the course is to make the students aware of various soil investigation methods, theoretical and practical approach to calculate the bearing capacities of different foundations and the design of various su**b** structural elements**.*

Module 1 (12 Hours)
>   **Site investigation and Soil exploration:** Objectives - Planning – Stages of Explorations-- Depth and spacing of borings-Methods of explorations- test pits, borings (auger boring and wash boring)- sub surface soundings (standard penetration and cone penetration) - geophysical methods (seismic refraction and electrical resistivity methods) –Samples-disturbed and undisturbed samples -sampling tools- - Bore log - Soil profile - Location of water table.
>   **Stress Distribution:** Boussinesque's equations for vertical
>   pressure due to point loads, line load and uniformly loaded circular area. - assumptions and limitations - Pressure bulb- Newmark charts and their use.Wetergaard's equation for point loads-appriximate methods of stress distribution.

Module 2 (12 Hours)
>   **Earth Pressure:** General & local State of plastic equilibrium. Earth pressure at
>   rest , active and passive. Rankine's and Coulomb's theories of cohesion less and
>   cohesive soils - Iinfluence of surcharge and water table.Rehban's and Culman's graphical methods. Sheeting and bracings in excavations.
>   Sheet Piles**:** Common types of sheet Piles – Uses of sheet pile walls

Module 3 (12 Hours)
>   **Bearing capacity:** Definitions - ultimate and allowable - plate load test -
>   - Terzaghi's and Skempton's analysis - bearing capacity factors and
>   charts - effect of water table - bearing capacity from building codes and SPT values-Methods of improving bearing capacity - vibroflotation and sand drains.
>   **Settlement analysis:** Distribution of contact pressure- estimation of immediate
>   and consolidation settlement - causes of settlement - permissible, total and
>   differential settlement - methods of reducing differential settlement.

Module 4 (12 Hours)
>   **Foundation:** General consideration - Functions of foundation - shallow and deep
>   foundation - different types of foundation -Selection of type of foundation-steps
>   involved.
>   **Footings**: Design of individual, continuous and combined footings - footings

subjected to eccentric loading - proportioning footings for equal settlement.

Module 5 (12 Hours)

Raft foundation: Types of rafts- bearing capacity equations - design procedure – floating foundation.

Pile foundation: Uses of piles - Classification of piles - Determination of load carrying capacity of axially loaded single vertical pile (static & dynamic formulae) -Pile load tests - Negative skin friction - Group action & pile spacings - Settlement of pile group.

Caissons: Open, box, and pneumatic caissons, construction details of well foundation - problems of well sinking.

Note: Structural design of foundations is not contemplated in this course.

References

1. Arora K. R, Soil Mechanics & Foundation Engineering, Standard Publishers , Distributors.
2. Joseph E.Bowles, Foundation Analysis and Design, McGraw Hills Publishing Company.
3. Ninan P. Kurian, Modern Foundations, Tata McGraw Hills Publishing Company.
4. Peck, Hansen & Thornburn, Foundation Engineering.Wiley Eastern Limited
5. W.C. Teng, Foundation Design.Prentice Hall of India
6. Hans. F. Winterkorn & Hsai Yang Fang, Foundation Engineering Hand Book, Van Nostrand Reinhold Company.
7. B. C Punmia,Soli Mechanics and Foundation Engineering,Laxmi Publications.
8. V.N.S. Murthy,Text book of Soil Mechanics and Foundation Engineering,CBS Publishers

CE010 603 STRUCTURAL ANALYSIS II

Teaching scheme   **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective:
To equip the students with the comprehensive methods of structural analysis of indeterminate structures
To give an introduction to Theory of Elasticity and Structural Dynamics.

Module 1 (10 hours)
Plastic theory – ductility of steel- plastic bending of beams- evaluation of fully plastic moment – plastic hinge – load factor – method of limit analysis- basic theorems- collapse load for beams and portal frames.

Module 2 (12 hours)
Approximate methods of frame analysis: Frames under lateral loading-portal method – cantilever method. Frames under vertical loading –substitute frame method.
Space frames – tension coefficients-tension coefficient method applied to space frames

Module 3 (12 hours)
Kani's method-continuous beams & frames (without sway only).
Influence line diagrams for statically indeterminate structures: Muller Breslau' s principle-Influence lines for reactions-shear force-bending moment-propped cantilever& two span continuous beams.

Module 4 (14 hours)
Elementary theory of elasticity: State of stress at point- stress tensor-equilibrium
Equations - stresses on arbitrary plane- principal stresses-strain components – strain tensor- compatibility equations- boundary condition equations Two dimensional problems- plane stresses - plane strain – compatibility equations in two dimensional cases- Airy's stress functions

Module 5 (12 hours)
Introduction to Structural Dynamics-Dynamic systems and loads-Free or natural vibrations-Natural Frequency- Inertia force- -D'Alembert's principle- Mathematical modeling of single degree of freedom systems- equivalent spring stiffness of combination of springs

References

1. Timoshenko S.P., Theory of Elasticity, McGraw Hill.
2. Sreenath L. S, Advanced Mechanics of Solids, Tata McGraw Hill Education P. Ltd.
3. Sadhu Sindh, Strength of Materials, Khanna Publishers, 1988.

4. Bhavikatti S.S , Structural Analysis Vol. II, Vikas Publishing House (P) Ltd.
5. Seeli F.B.&Smith J.P., Advanced Mechanics of Materials, John Wiley & Sons, 1993.
6. Vazirani & Ratwani, Analysis of Structures, Khanna Publishers, New Delhi.
7. B.C. Punmia, Theory of Structures, Vol. II, Laxmi Publishers, New Delhi.
8. Prakash Rao D.S., Structural Analysis, Universal Press Ltd, Hyderabad, 1997.
9. Ameen A, Computational Elasticity, Narosa Publishers.
10. Ray W Clough, Joseph Penzien, Dynamics of structures, Mc Graw Hill, Kogabusha Ltd.
11. Madhujith Mukopathyay, Structural Dynamics, vibrations&systems, Ane Books Pvt. Ltd, 2008.
12. V.K.Manicka Selvam, Elementary Structural Dynamics, Dhanpat Rai Publications Pvt.Ltd.
13. Mario Paz, William Leigh, Structural Dynamics, Springler.

CE010 604   TRANSPORTATION ENGINEERING - I

Teaching scheme: **Credits: 4**
3 hour lecture and 1 hour tutorial per week

Objective: *To gain an in-depth knowledge on operating characteristics of facilities such as railways and water transportation*

Module 1(15 hours)
  Introduction: Transportation modes **-** comparison and characteristics of highway and railway. Modern developments – Surface, elevated and tube railways, light rail transit, high speed tracks - technologies
  Railway track: Alignment- basic requirements and factors affecting selection, Component parts of a railway track - requirements and functions - Typical cross section - Rails – functions and requirements, Type of rail sections, rail fastenings, wear and creep of rails - coning of wheels, Train resistances and evaluation of hauling capacity and tractive effort of locomotive.
  Geometric design of railway track: Horizontal curves, radius – super elevation - cant deficiency - transition curves - gradients - different types - Compensation of gradients.

Module 2 (10 hours)
  Railway operation and control: Points and Crossings – Design features of a turn out – Details of station yards and marshalling yards – Signaling, interlocking of signals and points - Principles of track circuiting - Control systems of train movements – ATC, CTC – track circuiting

Module 3 (10 hours)
  Tunnel Engineering: Tunnel - sections - classification - tunnel surveying - alignment, transferring centre, grade into tunnel – tunnel driving procedure - shield method of tunneling, compressed air method, tunnel boring machine, Tunnel lining, ventilation - lighting and drainage of tunnels.

Module 4 (15 hours)
  Harbour Engineering: Harbours – classification, features, requirements, winds and waves in the location and design of harbours.
  Break waters - necessity and functions, classification, alignment, design principles, forces acting on break water – construction, general study of quays, piers,   wharves,   jetties,   transit   sheds   and warehouses - navigational aids - light houses, signals - types - Moorings
  .
Module 5 (10 hours)
  Dock Engineering: Docks - Functions and types - dry docks, wet docks – form and arrangement of basins and docks – design and construction – dock entrances - floating dry docks, slip ways, dock entrances and caissons. Dredging – functions -

general study of dipper dredger, grapple dredger, ladder dredger and hydraulic dredger.

References

1. Rao G. V, Principles of Transportation and Highway Engineering, Tata McGraw Hill
2. Mundrey J. S, Railway Track Engineering, Tata McGraw Hill
3. S.C. Rangawala, Railway Engineering, Charotor Publishing House
4. S. C Saxena and S. P Arora., Railway Engineering, Dhanpat rai & Sons
5. Subhash C. Saxena, Railway Engineering, Dhanpat rai & Sons
6. R. Srinivasan, Harbour, Dock & Tunnel Engineering, Charotor Publishing House
7. S.P.Bindra, A course in docks and Harbour Engineering, Dhanpat rai & Sons

CE010 605 WATER RESOURCES ENGINEERING

Teaching scheme: **Credits:4**
 3 hours lecture and 1 hour tutorial per week

Objective :
Students are expected to realize the importance of water resources and its application in irrigation engineering.

Module 1 (15 hours)
Irrigation: Definition-necessity of irrigation - environmental effects of irrigation - sources of water - irrigation systems- lift and flow irrigation – modes of irrigation - layout of irrigation schemes -historical development of irrigation in India through ages. Soil-water-plant relation – water requirement for crop -optimum moisture for crop growth - depth of water and frequency of irrigation -crop seasons and important crops in India. Crop period and base period - duty,delta and their relationship - factors affecting duty - commanded areas and intensity of irrigation. Consumptive use of water - evapotranspiration -determination of consumptive use - irrigation efficiencies.

Module 2 (15 hours)
Basic concepts of hydrology: Hydrological cycle and its components - rainfall - rain gauge- mean precipitation over a catchment area - run off - factors affecting runoff - hydrograph - direct run off and base flow - unit hydrograph - S. hydrograph – applications of unit hydrograph.
Estimation of runoff: Empirical formula, infiltration method, rational method - flood estimation - flood frequency, unit hydrograph method and empirical formula.

Module 3 (15 hours)
 Ground water: Definitions- porosity - specific yield - specific retention - storage coefficient-coefficient of permeability and transmissibility. Ground water velocity- Darcy's equation - flow towards wells - Dupit's theory of aquifers. Wells-shallow wells - deep wells - yield of an open well - constant level pumping test and recuperation test - tube wells - strainer, cavity and slotted tube wells- factors governing the selection of site and type of tube wells. Infiltration galleries and wells.

Module 4 (15 hours)
Flow irrigation: canal system - classification of canals and their alignment - requirements of a good distribution system-balancing depth - section of canal. Design of canals in alluvial soils - silt theories - non silting and non scouring velocity. Kennedy's theory -Lacey's theory - design of unlined canal using the two theories in alluvial soils - bed load and suspended load - canal outlets - requirements of good canal outlets - non modular - semi modular - modular outlets.

Module 5 (12 hours)
Reservoir planning: Investigation - selection of site - storage zones in a

reservoir - mass inflow curve - demand curve - calculation of reservoir capacity and safe yield from mass inflow curve - reservoir sedimentation - reservoir sediment control - single purpose reservoirs - multi purpose reservoirs - useful life of a reservoir. River training works: guide banks, groynes and marginal bunds – flood control - causes - methods of flood control - principles of flood routing. Soil conservation: water logging and its control - reclamation of salt affected land.

References

1. P.M.Modi, Irrigation-water recourses and water power, Standard book house, Delhi.
2. S.K Garg, Irrigation and hydraulic structures, Khanna Publishers, Delhi
3. R.K.Linsley, M.A.Kholar&J.L.H.Paulhur, Hydrology for Engineers, Mc Grawhill bookco., New York.
4. Bharat Singer, Fundamentals of Irrigation Engineering.
5. V.B.Priyani, Irrigation and Waterpower Engg, Charota Book stall Anand.
6. Dr.B.C.Punmia&Dr.Pande.B.B.Lal, Irrigation & Water Power Engineering, Laxmi Publications

CE010 606L01 ADVANCED SURVEYING
(ELECTIVE I)

Teaching Scheme   **Credit:4**
2 hours lecture and 2 hours tutorial per week**.**

Objective:
To make the students aware of the advanced methods of surveying.

Module 1(12 Hours)
Total station surveying-study of instrument-measurement of parameters-methods of surveying-transferring data-software's-auto plotter-plotting (assignment).

Module 2 (12 Hours)
Arial photogrammetry: Definition- types of photographs- geometry of photographs – parallax - pair of photographs- height determination- flight planning- stereoscopy.

Module 3 (12 Hours)
Remote sensing: Introduction and definition of remote sensing terminology- principles and methods of remote sensing- electro-magnetic radiation and spectrum- radiation sources-interference- atmospheric effects on remote sensing- atmospheric window –energy interaction with surface features-different types of platforms- sensors and their characteristics-orbital parameters of a satellite- multi concepts in remote sensing.

Module 4 (12 Hours)
Interpretation of images: Aerial photo interpretation – basic elements -techniques of photo interpretation- application of aerial photo interpretation-photographs versus maps- interpretation of satellite images- ground truth collection and interpretation and verification- advantages of multi date and multi band images.

Module 5 (12 Hours)
Applications: Applications in water resources management- land use mapping and monitoring- soil sciences- geology- agriculture- forestry - oceanography.

References
1. Thomas M. Lillesand & Raiph W. Kiefer, "Remote sensing and image interpretation", John Wiley Sons.
2. Floyd F. Sabins, "Remote sensing principles and interpretation", Freeman and company.
3. Campbell J. B, "Introduction to remote sensing", The Guilford press, London.
4. Curran P.J., "Principles of remote sensing", Longman, London.
5. Engmen E.T and Gurnay R. J.,"Remote sensing in hydrology", Chapman and Hall.
6. Wolf P.R., "Elements of photogrammetry", McGraw Hills.

CE010 606L02 OPEN CHANNEL AND COASTAL HYDRAULICS
(ELECTIVE - 1)

Teaching Scheme   **Credit:4**

2 hours lecture and 2 hours tutorial per week**.**

Objective:

To develop theoretical and practical knowledge on open channel flow and to acquire basic knowledge on Ocean Engineering **and related applications**.

Module 1(12 Hours)

Open channel flow-Definition-Importance-Classification of flows
 Uniform flow- Resistance equation-Chezy's and Manning's equation-roughness coefficient.-factions affecting roughness coefficient- normal depth and its computation-conveyance – section factor - specific energy - specific force - diagram – critical flow - section factor -hydraulic exponent for critical flow computation and its use for trapezoidal channel-Application of specific energy and specific force in open channel
.

Module 2(12 Hours)

Non-uniform flow - friction slope - differential equation of non-uniform flow - types of surface profiles - the point of control - computation by Bresse's method and the simplified step method.

.**Module 3(12 Hours)**

Hydraulic jump - sequent depths - dimensionless equation of the jump - loss of head - the jump at the foot of a spillway - criteria for the formation of a jump - use of jump as an energy dissipater. Control of jump by sills - stilling basins

Module 4(12 Hours)

Water waves - classification into periodic oscillatory, periodic progressive, uniformly progressive, solitary and stationary waves.
 Ocean waves – Introduction-characteristics-classification based on wave period. Small amplitude wave theory .expression for the celerity of deep water gravity wave and shallow water gravity wave - determination of the wave length and celerity for any water depth given the deep water wave amount as wave energy (no proof).
Wave Transformations –shoaling- refraction- reflection-diffraction –wave breaking (description only.

Module 5(12 Hours)

Long period waves-astronomical tide-tsunami, basin oscillations, storm surge, climatologic effects, geologic effects(description only)
Wave forecasting - SMB method.
Coastal erosion with special reference to the Kerala Coast

Shore protection measures – break waters of different types-sea walls – tetrapods, groynes and beach nourishment.

References
1. S.M.Woodword, C.J.Posey, Hydraulic of Steady Flow in Open Channels
2. F. N. Henderson, Open Channel Flow
3. A. I. Ippen, Estuary and Coast line Hydrodynamics
4. K. E. R. I. Peechi, Coastal Engineering Publications
5. V. T. Chow, Open Channel hydraulics, Mc Graw Hill
6. Robert .M. Sorensen, Basic coastal engineering, John Willey & Sons

CE010 606 L03   AIRPORT ENGINEERING (ELECTIVE I)

Credits 4

Teaching scheme: 2 hour lecture and 2 hour tutorial per week

Objective: To understand the various aspects of air transportation and airport operation and design.

Module 1 (15 hours)

Introduction – history of air transport - structure and organization –- selection of site – surveys – drawings to be prepared - Airport planning – components of airport system – airport planning studies – elements of study – forecasting - levels – methodologies – extrapolation methods – market analysis models – forecasting requirements – applications
Aero plane component parts - Aircraft characteristics – classification of airports
Airport obstructions - clear zone and turning zone - zoning laws - regional planning – airport architecture – environmental considerations

Module 2 (12 hours)

Runway design – orientation - windrose and layout of runways - basic runway length and corrections required - geometric design - balanced field concept - Terminal area – planning and design – passenger flow – size of apron – apron turntable - hangars – protection from jet blast

Module 3 (12 hours)

Airport capacity – capacity and delay – runway capacity related to and not related to delay - Air traffic control – flight rules - service station – Air Traffic Control network – aids for the control of air traffic – automation in air traffic control

Module 4 (11 hours)

Airport pavements – design factors – design methods for flexible and rigid pavements – CBR method – McLoad method – Burmister method – Analytical method –design charts – Load Classification Number System – Joints in cement concrete pavements

Module 5 (10 hours)

Taxiway design - loading aprons - holding aprons - separation clearances – visual aids - airport markings - marking of runways, taxiways - Airport lighting - lighting of runways approaches, taxiways and aprons.

References
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1. S.K. Khanna, M. G. Arora, S.S. Jain, Airport Planning & Design, Nem Chand Publishers
2. S. C. Rangwala, Airport Engg., Charotar Publishing Co.
3. Robert Horenjeff & Francis X McKelvy, Planning and design of airports, Mc Graw Hill.

CE010 606L04 ADVANCED MECHANICS OF MATERIALS
(ELECTIVE-1)

Teaching Scheme   **Credit:4**
2 hours lecture and 2 hours tutorial per week**.**
Objective
To review and make more useful methods and results presented in the previous courses on Mechanics of materials.
To understand the limitations of the ordinary formula of Strength of materials and to extend the subject to include a variety of important topics more complex than those usually involved in earlier courses.

Module 1 (13 Hours)

Basic concepts – Body force – Surface force – Stresses and strains – Three dimensional stresses and strains – Transformation equations of 3D stresses and strains – Principal stresses & strains – States of stresses and strain – Equilibrium equations – Generalised Hooke's Law – Compatibility Conditions – Boundary conditions.

Module 2 (13Hours)

Two dimensional problems – Plane stress and plain strain – Transformation equations – Stress–strain relations – Equilibrium equations in cartesian and polar co-ordinates – Airy's stress function – Biharmonic Equilibrium – 2D problems in Cartesian coordinate – Cantilever with concentrated load at free end – Simply supported beam with uniformly distributed load.

Module 3 (12Hours)

Torsion – Torsion of prismatic bar – General solution – Warping function approaches – St. Venant's theory – Membrane analogy – Sand heap analogy – Torsion of Non Circular sections – Torsion of multi cell and thin walled open and closed sections.

Module 4 (11Hours)

Curved flexural members – Winkler- Bach formula – Equivalent area methods – Circumferential stress in curved beams having, I,T or similar cross sections – Closed ring with circumferential load and uniform loads – Chain links.

Module 5 (11Hours)

Beam on Elastic foundation – General theory – Infinite beam subjected to concentrated load – Beam with uniformly distributed loads – Short beams.

References:–

1. Timoshenko S P and Goodier J. N, *Theory of Elasticity*, Tata Mcgraw Hill International Student Edition.
2. Sadhu Singh, *Theory of elasticity*, Khanna Publishers, Delhi.
3. Srinath L. S, *Advanced mechanics of solids*, Tata McGraw– Hill Publishing Company Ltd., New Delhi.

4. Arthur P Boresi & Omar M SideBottom, *Advanced Mechanics of Materials*, John Wiley & Sons.
5. Hetenyi, *Beam on elastic foundation*

CE010 606L05 CONCRETE TECHNOLOGY
(ELECTIVE - I)

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
Concrete technology is one of the important disciplines of Civil Engineering involving the study of engineering properties and behaviour of concrete.

Module 1(13 hours)
> **Concrete materials**: cement: Bough's chemical compositions, Additives, Test for properties of cement- Physical, Chemical, Relevance and IS specification. Hydration – Product of hydration, Phases of concrete, Structure of Hydrated cement paste (HCP), Solids in HCP, Voids in HCP, Water in HCP. Structure property relationship in HCP: Strength, Dimensional stability and Durability. Transition Zone in concrete:- Significance of transition zone, Structure of transition zone ,Strength of transition zone and Influence of transition zone. Aggregates: - requirements, size , shape and texture, Grading of aggregate, Aggregates crushing strength, Specific gravity, Flakiness index, Elongation Index, Impact value, Abrasion value, IS specification. Alkali aggregate reaction. Water: - General requirement, Quality.

Module 2 (12 hours)
> **Fresh Concrete**: Workability - factors affecting - measurement of workability - different tests for workability - segregation - bleeding - process of manufacture of concrete - Batching - mixing - transportation - compaction - curing of concrete - curing methods - admixtures in concrete - air entraining agents - Accelerators – Retarders -workability agents - Damp proofing agents - Miscellaneous admixtures - quality control.

Module 3 (12 hours)
> Elastic properties of Concrete - factors affecting modulus of elasticity – Strength of concrete: w/c ratio - gel/space ratio - Gain of strength with age. - accelerated curing tests - maturity concept of concrete - effect of maximum size of aggregate on strength - relation between compressive and tensile strength - revibration - high speed slurry mixing - creep - shrinkage - factors affecting.

Module 4 (12 hours)
> **Durability of concrete**: - sulphate attack - methods of controlling sulphate attack. Durability of concrete in sea water - action of organic acids, mineral oils, sugar etc. on hard concrete - thermal properties of concrete - Fire resistance cracks in concrete–Remedies, Testing of Hardened concrete, flexural strength - comparison of cuube test and cylinder test - Indirect tension test methods -concrete mix design - IS methods - ACI methods - mean strength - characteristic compressive strength - Non distructive testing of concrete.

Module 5 (11 hours)

      Special aggregates: light weight - artificial - natural - special concrete - no - fine concrete- high density concrete - Sulphur infilterated concrete - fibre reinforced concrete - polymer concrete polymer impregnated concrete - polymer cement concrete - properties of polymer concrete - special concreting methods - cold Weather concreting, hot weather concreting - Ferrocement.

References
1. Krishna Raju N, Concrete Technology
2. A.M. Neville, Properties of concrete
3. M.S. Shetty, Concrete Technologyeferences:
4. A.R Santhakumar-Concrete Technology- Oxford University Press

CE010 606L06 SOIL STABILITY ANALYSIS
(ELECTIVE - 1)

Teaching Scheme   **Credit:4**
2 hours lecture and 2 hour tutorial per week.

Objective:
Slope stability problem like,slides,flows and falls often produce extensive property damage and therefore geotechnical engineers frequently need to evaluate the stability of existing slopes and proposed slopes. The objective of the course is to make the students aware of various causes of failures of slopes and study the remedial measures

.
Module 1 (12 hrs.)
> Ground water seepage- Laplace' s equations for two dimensional flow- quick sand condition- construction of flownets- confined and unconfined flow-seepage in anisotropic soil conditions-piping-design of filters.

Module 2 (12 hrs.)
> Stability of earth slopes-modes of slope stability- analysis of slope stability problems- Swedish circle method- Friction circle method- Taylor' s stability chart-
> Bishop' s method- stabilization measures- instrumentation.

Module 3 (12 hrs.)
> Landslides: Introduction- movements associated with landslides-causes of landslides-consequences, classification and analysis of landslides-investigation of landslides-instrumentation-methods of preventing landslides.

Module 4 (12 hrs.)
> Earthquake effects on soil foundation system: earth quakes- ground shakingliquefaction-ground deformations-seismic provisions in building codes

Module 5 (12 hrs.)
> Underpinning: Introduction-reasons-pit underpinning-pile underpinning-driven underpinning piles-shoring-special underpinning methods-moving structures

References
1. Hans.F.Winterkorn and Hsai Yang Fang Foundation Engineering handbook -
Van Nostrand Reinhold Company
2. Bowles E.J. Foundation analysis and Design. Mc Graw Hill Publishing Co.
3. Gopal Ranjan and A.S.R.Rao Basic and applied Soil mechanics New Age
International Publishing Company
4. Donald.P.Coduto Geotechnical Engineering –Principlesand practices, Prentice
Hall India

CE010 607 COMPUTER AIDED DESIGN AND DRAFTING LAB

Teaching Scheme   **Credit: 2**
3 hours practical per week

Objective
To provide familiarity with functional requirements and regulations related to buildings and to enable students to prepare neat building drawings with CAD software so as to minimize effort and maximize output.

Exposure to different categories of building (Private, Public, Residential, Flats, Offices, Clubs/Recreational buildings etc.- **Local visit and preparation of sketches**

Functional requirements of buildings – Different functional units of a building- Requirements regarding Area, Height, Head room, Width of passage way, Lighting, Ventilation, Public amenities, Setback, Parking, clearance from electric lines, Provision and location of septic Tank- clearance from well, Familiarity with norms in National Building Code and local building rules. **Study of building plans** (Residential / Commercial / Public buildings / Office/Flats / Cottages etc.) **sanctioned by local authority**.

Preparation of 2D drawing- Advantages of CAD over manual drafting- Features of CAD software-menus and tool bars-Concept of drawing in true size- Drawing units- Drawing tools- Editing tools- Controlling display-(zoom, pan, regeneration, redraw) Productivity tools- mirror,copy,block,array,Detailing-layers,color,linetype,ltscale,hatch Inquiry –area, dimension Plotting- scale. Specifications for drawings

Preparation of 3D drawings- Concept of 3D drawing- viewpoint, real-time 3D rotation, 3D modeling techniques- wire modeling, surface modeling, surface revolution, 3D face. Elevation and thickness - addition and subtraction of 3d objects. Shading - rendering.

Application of CAD to Civil Engineering Drawing with emphasis on architectural appearance. Residential, Public buildings complete in all aspect including layout plan, section, elevation, details/specifications/joinery and site plan taken in standard scale with title block.

Exposure to 3D studio and 3D Max

A term project submitted individually and suitable for submitting to local bodies for approval incorporating local building rules and NBC provisions is compulsory for external evaluation.

Assignments:- Submission of neat dimensioned line sketches from local visit
                Collection and study of approved building plan
                Preparing an Elevation for given plans
                Preparing Plans based on requirements of clients.
References

1. Reference manual of the package.

2. National building code of India.
3. Shah & Kale, Building Drawing, Tata McGraw Hill.
4. Balgopal T.S.Prabhu, Building Drawing and Detailing, SPADES Calicut.
5. Sham Tickoo, Understanding Auto CAD2002, Tata McGraw Hill.
6. Sham Tickoo, Auto CAD2002 with applications, Tata McGraw Hill.

CE010 608 MATERIAL TESTING LABORATORY - II

Teaching scheme   **Credits: 2**

3 hours practical per week

Objective:

To study properties of concrete and its various constituent materials.

1. Tests on cement.

a) Standard consistency, initial and final setting time.

b) Compressive strength of mortar cubes.

c) Specific gravity. d) Soundness. e) Fineness.

2. Tests on fresh concrete.

a) Compaction factor test.

b) Slump test.

c) Vee-Bee test.

d) Flow table test.

e) Ball penetration test.

3. Tests on hardened concrete.

a) Compressive strength of concrete cubes.

b) Compressive strength of concrete cylinder.

c) Splitting tensile strength.

d) Modulus of elasticity.

e) Flexural strength.

4. Tests on RC beam

5. Tests on aggregates.

a) Aggregate crushing value for coarse aggregate.

b) Specific gravity of coarse and fine aggregate.

c) Bulking of fine aggregate.

d) Bulk density and percentage voids of coarse aggregate.

e) Grain size analysis of coarse and fine aggregate.

6. Tests on bricks.

a) Compressive strength. b) Water absorption. c) Efflorescence.

7. Tests on roofing tiles.

a) Transverse strength. b) Water absorption.

8. Tests on flooring tiles.

a) Transverse strength. b) Water absorption. c) Abration tests.

9. Compression tests on Laterite blocks

10. Study of

a) Strain measurements using electrical resistance- strain gauges.

b) Nondestructive test on concrete.

Note

All tests should be done as per relevant BIS.

References

1.A.R.Santhakumar,Concrete Technology,Oxford University Press,Chennai.
2. M. S. Shetty, Concrete technology, S.Chand & Co.

CE010 701 DESIGN OF HYDRAULIC STRUCTURES

Teaching scheme: **Credits: 4**
2 hours lecture and 2 hours tutorial per week

   Objective: *Students are expected to know the details of major and minor irrigation structures and their design. A student, who successfully completes the course, should be able to carry out design of various hydraulic structures in the given field conditions.*

Module 1 (13 hours)
Dams: classifications - factors governing the selection of the type of dam and site of the dam- **Gravity dam**: forces acting - modes of failure and stability requirements - elementary profile and practical profile - principal and shear stress - base width of elementary profile by stress and stability criteria-stresses developed in the elementary profile - low and high gravity dam –   design of gravity darn (introduction only) – galleries ,joints , keys ,water stops –foundation treatment - brief description on types of spill ways.
Module 2 10 hours)
Arch dams: types of arch dams –forces acting –design methods-design of arch dams on thin cylinder theory only– central angle for min. concrete- limitations -Introduction of other methods of design - thick cylinder theory, trial load analysis and elastic theory.
Buttress dam - types - advantages and disadvantages.
Earthen dam - types of earth dams - causes of failure - design criteria -- phreatic line in an earth dam with horizontal drainage filter - different dam sections to suit available materials and foundation.
 Rock fill dam –materials of construction-impervious membrane type and earth core type (brief description only)
Module 3 (13 hours)
Diversion head works: function and component parts of diversion head works -effect of construction of weir on the regime of river- causes of failure of weirs on permeable foundation. Bligh's creep theory and its limitations - Lane's weighted creep theory - Khosla's theory and design of impermeable foundation - design of vertical drop weir - silt control devices - silt excluder, silt ejector.
Module 4 (13 hours)
Canal regulation works-design of head regulator and cross regulator- Canal falls-necessity and location of falls-types-design of vertical drop fall- Sarda type only and siphon well drop . (Design emphasizing the hydraulic aspects only)
Module 5 (11 hours)
Cross drainage works –necessity-types-design of aqueduct and syphon aqueduct.
Water power engineering: Classification of hydel plants- runoff river plants, storage plants and pumped storage plants - low, medium and high head schemes -investigation and planning - fore bay – intakes - surge tanks - penstocks -powerhouse – selection of turbine-Scroll casing - draft tube – tail race- definition of gross head - operating head - effective head - firm power –secondary power- load factor, capacity factor and utilization factor.

Note:
Only sketches are required for all designs.

References
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1. S. K.Garg, Irrigation and hydraulic structures, S. K.Garg, Khanna publishers
2. P. M. Modi, Irrigation-water resourses and water power, Standard book house.
3. B C Punmia, Pande B B Lal, Irrigation and water power engineering, Laxmi Publications
4 R. K. Linsley, M. A. Kholer, L. H. Paulhur, Hydrology for Engineerers, Tata Mc Graw Hill
5. V. B. Priyani, Irrigation and water power Engg. , Charotar Book stall.
6 G.L. Asawa , Irrigation and water resources Engg. ,New Age International Limited Publishers.
7   Sathyanarayana Murthy , Water Resources Engineering , Wiley Eastern
8   R.S.Varshney, S.C.Guptha, R.L.Guptha, Theory and design of irrigation Structures, Vol II, Nemchand &brothers, Roorkee.

CE010 702   ENVIRONMENTAL ENGINEERING - I

Teaching scheme: **Credits: 4**
2 hour lecture and 2 hour tutorial per week

Objective:
- *To understand the basic principles of Water Supply Engineering*
- *To develop knowledge in unit operations and design of water treatment systems*

Module 1(10hrs)

Scope of **Environmental Engg**. Water supply Engineering: Rural and Urban water supply systems - **water demand** - percapita demand, factors affecting percapita demand, variations in the rate of consumption, fire demand, design period, forecasting population. **Quality of water**: impurities in water and their importance - water borne diseases - analysis of water - physical, chemical and bacteriological tests - MPN total coliforms, fecal coliforms. WHO and Indian standards for drinking water.

Module 2 (10hrs)

Collection of water: intakes - location, types, pipe materials **-** hydraulics-of flow - design of pipes - **Pumps**: Classification - selection of pumps - location of pumping stations. **Appurtenances** in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains. **Storage of water** - effect of storage on quality of water

Module 3 (15hrs)

General **layout** of treatment plant - surface water and ground water. **Aeration**, purpose of aeration. **Sedimentation** - plain sedimentation, theory of sedimentation, continuous flow sedimentation tanks. **Chemically aided sedimentation** - necessity, theory of coagulation and flocculation - generally used coagulants, dosage of coagulants- clariflocculators, design of flash mixers clarifiers and clarifloculators.

Module 4 (15hrs)

Filtration - Theory of filtration, filter media - sand for filtration. Classification of filters - design, construction, control, operation and maintenance of rapid sand filters and slow sand filters, pressure filters.
Disinfection: requirements of a good disinfectant, chlorination - action, application, and dosage chlorine demand, pre-chlorination, post chlorination, double chlorination, super chlorination, breakpoint chlorination. Other disinfectants.

Module 5(10hrs)

Miscellaneous treatment methods: color, odour and taste removal, iron and manganese removal, deflouridation, removal of hardness, desalination.
Distribution of water: pumping system, gravity system, pumping and storage system, distribution reservoirs -storage capacity of balancing reservoir, pipe grids,

methods of analysis of network. Detection and prevention of leaks in distribution system-cleaning and maintenance of distribution system, pipe corrosion and its control.

References:

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. M.N. Rao & H.V.N. Rao, Air Pollution, Tata Mc Graw Hill Pvt. Ltd., New Delhi.
3. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
4. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
5. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.

CE010 703   DESIGN OF CONCRETE STRUCTURES – II

Teaching Scheme   **Credit: 3**
2 hours lecture and 1 hour tutorial per week**.**
Objective
  To provide knowledge in the structural design of selected structures.

Module 1 (10 Hrs)
Prestressed Concrete: I S specifications- general principles- analysis of prestress and bending stress -methods and systems of prestressing – losses of prestress- design of simply supported rectangular beams with constant eccentricity only.

Module 2 (10 Hrs)
Retaining walls: Types-Earth pressure diagrams- modes of failure-design of cantilever and counter fort retaining walls ("L" not included)

Module 3 (8 Hrs)
Design of continuous beams: Using coefficients given in IS 456.
Circular beams: Uniformly loaded and supported on symmetrically placed columns

Module 4 (8 Hrs)
Domes: Membrane stresses in spherical and conical domes-design of domes with uniformly distributed and concentrated loads-openings-ring beams

Module 5 (9 Hrs)
Water Tanks: types-design of ground supported and overhead water tanks- circular with flat bottom-flexible and rigid joints-design of staging-columns and bracings-IS code method.

References
   1. Relevant IS codes (IS 456, IS 875, IS 1343, IS 3370 Part 2 and Part 4 ,SP 16)
   2. Park R and Pauloy T, Reinforced concrete structures, John wiley & sons Inc
   3. Purushothaman P, Reinforced concrete structural elements –Behaviour, analysis and design, Tata Mc Graw Hill Publishing Company Ltd
   4. Unnikrishna Pillai S & Devdas Menon, Reinforced concrete, Tata Mc Graw Hill Publishing Company Ltd
   5. Mallick S K, Reinforced concrete, oxford & IBH publishing company
   6. Varghese P C Limit state design of reinforced concrete structures, Prentice Hall of India pvt Ltd
   7. Ashok K Jain Reinforced concrete –Limit state design, new chand & bose
   8. Krishna Raju, prestressed concrete oxford and ibh publishing company ltd
   9. Ramamrutham S, Design of reinforced concrete structures, Dhanpat Rai publishing co
   10. Punmia B C Reinforced concrete structures vol 2. Laxmi publications

CE010 704 ARCHITECTURE AND TOWN PLANNING

Teaching scheme: **Credits: 3**
2 hour lecture and 1 hour tutorial per week
Objective:
- *To understand the basic principles of architectural design and functional planning of buildings*
- *To develop knowledge in town planning concepts and related principles*

Module 1 (10 hrs)
Architecture - Definition - factors influencing architectural development, characteristic features of a style - historical examples, Theory of architectural design – pragmatic, iconic, canonic and analogic design, Creative principles - function, strength, aesthetics, primary elements in architectural design, Design principles - unity, balance, proportion, scale, rhythm, character, contrast, texture, form perception, characteristics of form, form expressive of function- form related with material and structural system. Concept of space - activity space, circulation space and tolerance space

Module 2 (15 hrs)
Functional planning of buildings: Occupancy classification of buildings -general requirements of site and building - building codes and rules - licensing of building works. Functional planning of residential, institutional, commercial, process of identifying activity areas and linkages - circulation diagrams - checking for circulation, ventilation, structural requirements and other constraints, preparing site plan and working drawings

Module 3 (10 hrs)
Building Services:- Vertical transportation: Stairs -lay out and details of timber, masonry, metal, concrete and precast-concrete stairs-Elevators-drum and traction type, passenger and service goods elevators, design constraints of passenger elevators-handling capacity, arrangement of lifts, Escalators- features, operation arrangements, location - moving walk and moving ramp.
Ventilation and Air conditioning - ventilation requirements -natural and mechanical ventilation - cross ventilation - effect of orientation - calculation of air conditioning load - summer and winter air conditioning- consideration of comfort factors such as acoustics, lighting, and thermal aspects.

Module 4 (13 hrs)
Town planning - Evolution of towns-objectives and principles of town planning- growth of towns - problems of urban growth- garden city movement, conservative surgery and comprehensive planning, Radburn plan - evolution in town planning acts and legislation - forms of planning - requirements of new towns - surveys – zoning - transportation network and planning – housing, neighbourhood unit planning, - legislation on environmental pollution - land use planning and theories.

Module 5 (12 hrs)
Planning process:- Master plan, preparation and execution- -planning standards for different land use allocation for commerce, industries, public buildings, parks and play grounds.-implementation of development plans - land acquisitions - slums - causes and clearance schemes

References:
1. G.K Hiraskar The great Ages of World Architecture – Dhanpat Rai Publications (P) Ltd.
2. Satish Chandra Agarwala – Architecture and Town Planning- Dhanpat Rai and Co
3. Banister Fletcher, History of World Architecture, Taraporevalas.
4. Broadbent, Theory of Architecture Design, John Wiley Sons
5. V.K Jain – Hand book of Designing and installation of services in building complex –   khanna publishers
6. Rangwala – Town planning – charotar publishing house.
7. G.K Hiraskar – Fundamentals of Town planning – Dhanpat Rai publications.
8. Abir Bandyopadhyay – Text book of Town planning – Books and Allied (P) Ltd.
9. N.K Gandhi – Study of Town and Country planning in India – Indian Town and Country planning Association.

Teaching scheme: **Credits :3**
2 hour lecture and 1 hour tutorial per week

Objective: To understand the principles and design of highway, traffic and airport engineering

Module 1 (8 hours)

Classification, alignment and surveys -classification of highways - typical cross section of roads in urban and rural areas - requirements and factors controlling alignment of roads, engineering surveys for highway location.

Geometric Elements of highways: Highway cross sectional elements - pavement surface characteristics, camber and width requirements, median, kerbs, road margins – right of way, Sight distances - over taking zone requirements and related problems.

Module 2 (14 hours)

Geometric Design of Highways
Design of horizontal alignment - speed – horizontal curves, super elevation - methods of attainment of super elevation - related problems, radius - extra widening - transition curves Design of vertical alignment - gradient and grade compensation – Vertical curves - sight distance requirements on summit and valley curves - simple problems on design of vertical alignment.

Module 3 (8 hours)

Traffic Engineering: Traffic characteristics - traffic studies and their applications Traffic control devices- Traffic signs, traffic signals, road markings and traffic islands. Types of road intersection - kerb parking (Design of traffic signals not expected).

Module 4 (8hours)

Highway materials: Aggregates - desirable properties and tests - Bituminous materials - properties and tests - sub grade soil - desirable properties.
Pavement design: Basic difference between flexible and rigid pavements -factors affecting their design – design of flexible pavements-CBR & IRC Introduction to performance grading and superpave. Types and causes of failures in flexible and rigid pavements, highway drainage.
Highway construction and maintenance: Bituminous surface dressing, bituminous macadam.

Module 5 (10 hours)

Airport Engineering: Classification of airports - Aircraft characteristics-planning, selection of site for airport - factors to be considered. Runway orientation and layout of runways: use of wind rose diagrams, basic runway length and corrections required - Imaginary surfaces **-** approach zone and turning zone, obstructions and zoning laws - Stop way, clearway.

Aprons: factors controlling size and number of gate positions - holding apron aircraft parking systems – passenger terminal building- typical airport layout - airport markings - marking of runways, taxiways etc. Airport lighting: lighting of runways approaches, taxiways and aprons. Air traffic control **-** airways, navigational aids and landing aids.

References

1. S. K. Khanna, C. E. G. Justo, Highway engineering, Nem Chand Publications.
2. L .R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers.
3. L.R. Kadiyali, Principles and Practices of Highway Engineering, Khanna Publishers.
4. S.K. Khanna, M. G. Arora, S.S. Jain, Airport Planning & Design, Nem Chand Publishers
4. S. C. Rangwala, Airport Engg., Charotar Publishing Co.
5. Horenjeft, Robert & Francise Mc Kelvy, Planning and design of airports, Mc Graw Hill
6. G.V. Rao, Principles of transportation and High way Engineering, Tata Mc Graw Hill, New Delhi.
7. Robert. G. Hennes, Martin Ekse, Fundamentals of Transportation engineering, Tata Mc Graw Hill.
8. Theodore M Matson, Wilbur. S. Smith, Frederick.W.Hurd, Traffic Engineering, Mc Graw Hill.

CE010 706L01 BUILDING AUTOMATION AND SMART STRUCTURES
(Elective II)

Teaching Scheme   **Credit:4**
2 hours lecture and 2 hours tutorial per week**.**

Objective:
The course is designed to give an insight into the latest developments in construction field regarding the automated building services, smart materials and their use in structures.

Module 1 (14 hours)
Building Automation: Introduction, Building automation in residential buildings and commercial buildings, Difference between building automation and building control, Systems in building automation and building control, Structure of building automation and control networks, Energy management functions at management level, Room automation.

Module 2 (12 hours)
Building service control systems: Introduction, Building Management System (BMS)-control theory, benefits, Safety systems- life safety system, access control system, smoke detection system, fire sprinkler system, Comfort systems- occupancy sensors, temperature sensors, smart glass, light control system

Module 3 (12hours)
Eco friendly buildings – concepts of Green building, sustainable sites, brown field development, water conservation, energy conservation, ozone depletion, eco friendly building materials and resources, indoor environment quality maintenance, new innovative building designs for eco friendliness.

Module 4 (11hours)
Smart materials: Introduction, Piezoelectric materials, Piezoelectric properties, Vibration control, Embedded actuators, Fiber optics, Fiber characteristics, Fiber optic strain sensors, Applications of optical fibers, Electrorheological and Magnetorheological fluids, mechanism and properties, Applications.

Module 5 (11 hours)
Control of structures: Control strategies and limitations, Classification of control systems, Classical control, Modern control, Optimal control and Digital control.

References;
1. Clements-Croome D.J., *Intelligent Buildings: Design, management and operation*, Thomas Telford, London, 2004.
2. Craighead G., *High-rise security & fire life safety*, Butterworth-Heinemann, Boston, Amsterdam, 2003.
3. Atkin B., *Intelligent Buildings: Application of IT and Building Automation to High Technology Construction Projects*, Kogan Page, Michigan, USA, 1988.

4. Shengwei Wang, *Intelligent Buildings and Building Automation,* Taylor & Francis, New York, 2010.
5. H. Merz, T. Hansemann, C. Hübner, *Building automation: communication systems with EIB/KNX, LON and BACnet*, Carl Hanser Verlag, Germany, 2009.
6. IGBC, *Leadership in Energy and Environmental Design* (LEED-INDIA) Green Building Rating System.

CE010 706L02   GROUND IMPROVEMENT TECHNIQUES (Elective -II)

Teaching Scheme   **Credit: 4**
2 hours lecture and 2 hours tutorial per week.

Objective:
The rapid urban and industrial development pose an increasing demand for land reclamation and utilization of unstable and environmentally affected ground.
The objective of the course is to provide an opportunity to the students to familiarize with the recent developments and techniques in geo technical Engineering to improve the properties of such problematic /difficult soils.

Module 1 (15 Hrs)
Necessity of soil improvement-selection of improvement method- mechanical stabilization-effect on engineering properties-dewatering-well-point system electro osmosis-pre-loading- sand drains- methods of installation-vibroflotation and stone columns.

Module 2 (11 Hrs)
Chemical stabilization- cement stabilization- factors affecting soil cement mixing-admixtures- lime stabilization-effect of lime on soil properties -construction of cement / lime stabilized bases-bituminous stabilization- thermal stabilization- electrical stabilization.

Module 3 (11 Hrs)
Introduction to grouts and grouting- basic functions –classification of grouts-suspension grout and solution grout- groutability ratio –-properties of grouts- fluidity and viscosity, bleeding and stability,, rigidity and thixotropy, strength and permeance- grouting applications-seepage control in soil and rock under dams and for cut off walls-stabilization grouting for underpinning.and other applications

Module 4 (12 Hrs)
Earth Reinforcement- mechanism and concept- advantages-factors affecting-uses -design theories and stability analysis of retaining wall-external and internal stability-tie back analysis-coherent gravity analysis- application areas of earth reinforcement

Module 5 (11 Hrs)
Geotextiles: Soil improvement with geotextiles- classification- concepts-geotextiles as reinforcement, separators, filters, and drainage media-damage and durability of geotextiles

References
1.Purushotama Raj,P. Ground Improvement Techniques, Laxmi Publications
2.Koerner, R.M.,Construction and Geotechnical Methods in Foundation Engineering.   Prentice Hall
3. Koerner, R.M.,Designing with Geosynthetics,Prentice Hall

4. Swami Saran., Reinforced soil and its Engineering applications, I K International Publishing house
5. Sivakumar Babu., An Introduction to Soil reinforcement and Geosynthetics.,University Press.
6. Shroff A.V. and Shah D.L.,Grouting Technology in Tunelling and Dam construction. Oxford and IBH Publishing Co

CE010 706 L03 PRESTRESSED CONCRETE (Elective II)

Teaching Scheme **Credit: 4**
2 hours lecture and 2 hours tutorial per week.
Objective:
   Pre stressed concrete constructions are gaining its importance in Civil engineering .
   To under stand the analysis, systems and applications of pre stressed concrete structures.

Module 1 (10 hrs)
Introduction – Basic concept of prestressing – Materials for prestressed concrete - Classification of prestressed concrete – Advantages of prestressed concrete over reinforced concrete – Modes of failure of prestressed concrete – Systems of prestressing – Tensioning devices – Pretensioning – Post tensioning -   Thermo elasic and chemical prestressing.

Module 2 (10 hrs)
Analysis of prestress – Extreme fibre stresses – profile of tendons – Concept of load balancing – pressure line or thrust line – Internal resisting couple – Deflection of beams – Load ddeflection curve.

Module 3 (12 hrs)
Losses of prestress – Loss due to elastic shortening, shrinkage, creep, relaxation of steel – Loss due to anchorage slip – Loss due to friction – Overcoming friction loss – Design of tension members.

Module 4 V(14 hrs)
Elastic design of sections for flexure – sections and sections unsymmetrical about one axis – Design without tension and with tension – Design for shear and torsion – Ultimate moment of resistance.

Module 5 (14 hrs)
Anchorage zone – Stress distribution in end block – anchorage zone reinforcement – design of end block as per IS :1343 only – continuous beam – primary moment, secondary moment and resultant moment – concordant cable profile – Guyon's theorem – Evaluation of secondary moment.

References:–
1. N.Krishnaraju *Prestressed Concrete*, Tata McGraw-Hill Publishing Company 3rd Ed. (1985)
2. T.Y. Lin,*Design of Prestressed Concrete Structures*, John Wiley & Sons.
3. R. Rajagopalan, *Prestressed Concrete*, Narosa Publishers
4. IS: 1343, *Code of Practice for Prestressed Concrete*, Bureau of Indian Standards, New Delhi

CE 010 706L04   ENVIRONMENTAL IMPACT ASSESSMENT (Elective II)

Teaching Scheme   **Credit:4**
2 hours lecture and 2hours tutorial per week**.**

Objective:
- *To understand the basic principles of Environmental Impact Assessment*
- *To develop knowledge in various processes involved in EIA with case studies.*

Module 1 (14 hours)

Introduction: Concepts of environmental impact analysis, key features of National environmental policy act, Environmental protection acts, EIA methodologies - Screening and scoping - matrix and network methodologies for impact identification, description of the affected environment – environmental indices. Rapid EIA and Comprehensive EIA

Module 2 (14 hours)

Prediction and Assessment of Impact on Air and Water Environment: Basic information on air quality, sources and effects of air pollutants, key legislations and regulations, impact prediction approaches, assessment of significance of impacts, identification and incorporation of mitigation measures
Assessment of impact on water quality (surface and ground water), Vegetation and wildlife.

Module 3 (12 hours)

Prediction & Assessment of Impact on Noise & Social Environment: Basic information on noise, key legislation and guidelines, impact prediction methods, assessment of significance of impacts, identification and incorporation of mitigation measures, Environmental Risk Analysis, Definition of Risk, Consequence Analysis.

Module 4 (10 hours)

Decision Methods for Evaluation of Alternative: Development of decision matrix. Public participation in environmental decision making, techniques for conflict management and dispute resolution, verbal communication in EIA studies.

Module 5 (10 hours)

Introduction to Environmental Management Systems, Environmental Statement-procedures, Environmental Audit: Cost Benefit Analysis, Life cycle Assessment, Strategic EIA

References:

1. Canter L.W., Environmental impact assessment, McGraw-Hill, 1997
2. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.
3. Peter Morris & Riki Therivel, Methods of Environmental Impact Assessment, Routledge, 2001.
4. Denver Tolliver, Highway Impact Assessment, Greenwood Publishing Group, 1993.
5. R. K. Jain, L. V. Urban, G. S. Stacey, H. E. Balbach, Environmental Assessment, McGraw-Hill Professional, 2001.
6. Relevant IRC & CPCB codes.

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CE010 706L05   THEORY OF PLATES AND SHELLS (Elective-II)

Teaching Scheme   **Credit:4**
2 hours lecture and 2hours tutorial per week**.**

Objective :
To develop the skills for the analysis of advanced structures in civil engineering.

Module 1 (12 hrs)
Plates – Introduction – Classification of plates – Thin plates and thick plates – Assumptions in the theory of thin plates – Differential equation for cylindrical bending of rectangular plates – Pure bending of plates **–** Slope and curvature of slightly bent plates – Relation between bending moment and curvature in pure bending.

Module 2 (12 hrs)
Laterally loaded rectangular plates – Small deflections of laterally loaded thin plates – Differential equation of plates – Derivation of fourth order differential equation – Boundary conditions – Simply supported, built- in and free edges.

Module 3 (12 hrs)
Shells – Structural behaviour of shells – Parts of a shell – Classification of shells – Translational, rotational and ruled surfaces – Gauss curvature – Synclastic and anticlastic surfaces – Hyperbolic paraboloid – Elliptic paraboloid – Conoid.

Module 4 (12 hrs)
Classical theories of shells – Thin shell and thick shell – Stress resultants – Membrane theory of cylindrical shells – Formulation of equilibrium equations – Bending theory of cylindrical shells – Equilibrium equations – Beam theory.

Module 5 (12 hrs)
Circular cylindrical shells – Equilibrium equations – Expression for strain – Deformation of circular cylindrical shell – Cylindrical shell with uniform internal pressure – Pressure vessels – Calculation of bending moment and stresses in pressure vessels – attenuation length of edge effects.

References:

1. S.P Timoshenko, S.W Krieger, *Theory of plates and shells*, Mc Graw Hill.
2. J Ramachandran, *Thin shell theory and problems*, Universities press.
3. Krishna Raju N., *Advanced Reinforced Concrete Design*, CBS Publishers and distributers, New Delhi.
4. G.S Ramaswamy, *Design and Construction of Concrete Shell Roofs*, Tata- McGraw Hill Book Co. Ltd.,.

CE010 706L06 TRAFFIC ENGINEERING AND MANAGEMENT (ELECTIVE-II)

Teaching Scheme   **Credit:4**
2 hours lecture and 2hours tutorial per week**.**
Objective
The basic objective of this course is to introduce to the students the knowledge of traffic surveys and studies . The course also tries to expose the students, traffic management, capacity studies design of intersections, safety studies and the theories of traffic flow. They also become familiar with various traffic control and traffic management measures.

Module 1 (12 hrs)
Traffic management - scope of traffic management measures - restrictions to turning movements - one way streets - tidal flow operation - regulation of traffic - Need and scope of traffic regulations- Motor Vechicle Act - Speed limit at different locations- regualtion of the vechicle - regulations concerning the driver rules of the road enforcement.

Module 2 (12 hrs)
Highway capacity: Its importance in transportation studies - basic, possible and practical capacity - determination of theoretical maximum capacity -passenger car units - level of service - concept in HC manual - factors affecting level of service.

Module 3 (12 hrs)
Design of Intersection: Design of at grade & grade seperated intersection – rotary intersection - capacity of rotary intersection - traffic signals - design of fixed timesignal - pretimed signalised intersection - performance - Websters approach for the design.

Module 4 (12 hrs)
Traffic Safety: causes of road accidents - collection of accident data – influence of road, the vehicle .the driver, the weather and other factors on road accident - preventive measures.

Module 5 (12 hrs)
Traffic Flow: theory of traffic flow - scope - definition and basic diagrams of traffic flow- basic concepts of light hill - Whitham's theory - Car 'following theory and queuing

References
1. Khadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech
   Publishers
2. Khanna O.P and Jesto C.G; Highway Engineering, Nem Chand Publishers
3. Martin, Whol, Traffic system Analysis for Engineers
4. Donald Drew, Traffic Flow Theory

CE010 707   COMPUTER APPLICATIONS LAB

Teaching scheme: **Credits: 2**
3 hour practical per week

Objective:
To familiarize the students on the software packages for analysis , design and project management

Module I & II

- INTRODUCTION
Overview and the Environment of STAAD pro Package.

- GENERAL DESCRIPTION
Type of structure, Unit systems, structure geometry and Co-ordinate systems, global co- ordinate system, Local co-ordinate systems

- STAAD III -Commands- Using Edit Input-Command Formats-Text Input.

- STAAD PRE- Graphical Input Generation-"Concurrent" Verifications-Library- Geometry Generation – Dimensioning.

- STAAD POST – Graphical Post Processing – Animation – Icons – Isometric View – Zooming-Results of Analysis & Design – Query reports.

- LOAD – Member Load, Element Load, Joint Load, Floor Load, Self weight Command, Load case no, Load Combination .Load Generation for Wind Load, Seismic Load and Moving Load

- FINITE ELEMENT ANALYSIS & Dynamic Analysis.

- DESIGN for Concrete and Steel Structures using IS: 456 and IS 800 respectively.

Note
The student has to practice the above topics by working out problems in
1. Analysis and design of beams and trusses, Steel and RCC framed structures.
2. Analysis and design of multi-storied framed structures.

Module III & IV
Project management using CPM/PERT Software
(Microsoft Project /PRIMAVERA software)
1. Practice on the GUI of the software and Input of Date
2. Practice on Creating Bar Charts/Ghant charts
3. Practice on creating CPM/PERT charts and finding out critical path.
4. Practice on resource allocation and leveling of resources.
5. Practice on Project Monitoring (Cost &Time)
6. Plotting and printing of various charts and project

Note
The student has to practice the above topics by doing Project Management for Turn key projects related to Civil Engineering applications.

References
1. STAAD III Reference Manual
2. MS Project/PRIMAVERA Reference Manual

CE010 708 TRANSPORTATION ENGINEERING LAB

Teaching scheme: **Credits: 2**
3 hour practical per week

Objective:
 To make the students aware of the properties of various materials used in road constructions.

TEST ON SOIL
1.Califormia bearing ratio method.
TEST ON BITUMEN
2. Softeningpoint of Bitumen
3. Ductility test on Bitumen
4. Specific gravity of Bitumen
5. Flash and fire point test
6. Stripping value test
7. Viscosity using Viscometer
TESTS ON ROAD AGGREGATES
8. Aggregate crushing value test
9. Impact value test
10. Specific gravity test
11. Shape tests - Flakiness index and elongation index
12. Los angles abrasion test
13. Bulk density, specific gravity, void ratio and porosity of coarse aggregate,
water absorbtion.
TESTS ON MIXES
14. Marshell stability value
15. Determination of bitumen content by bitumen extractor.

References

1. S. K.Khanna, C. E. G. Justo, Highway engineering, Nem Chand Publications.
2. L .R. Khadiyali, Principles and Practices of Highway Engineering, Khanna Publishers.

CE 010 709 Seminar

Teaching scheme   **credits: 2**

2 hours practical per week

The seminar power point presentation shall be fundamentals oriented and advanced topics in the appropriate branch of engineering with references of minimum seven latest international journal papers having high impact factor.

Each presentation is to be planned for duration of 25 minutes including a question answer session of five to ten minutes.

The student's internal marks for seminar will be out of 50. The marks will be awarded based on the presentation of the seminar by the students before an evaluation committee consists of a minimum of 4 faculty members. Apportioning of the marks towards various aspects of seminar (extent of literature survey, presentation skill, communication skill, etc.) may be decided by the seminar evaluation committee.

A bona fide report on seminar shall be submitted at the end of the semester. This report shall include, in addition to the presentation materials, all relevant supplementary materials along with detailed answers to all the questions asked/clarifications sought during presentation. All references must be given toward the end of the report. The seminar report should also be submitted for the viva-voce examination at the end of eighth semester.

For Seminar, the minimum for a pass shall be 50% of the total marks assigned to the seminar.

CE 010 710 Project Work

Teaching scheme   **credits: 1**

1 hour practical per week

Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different disciplines.

The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.

- The project work has to be started in the seventh semester and to be continued on to eighth semester.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.
- Projects are expected to be proposed by the students. They may also be proposed by faculty member (Guide) or jointly by student and faculty member.
- Students are expected to finalise project themes/titles with the assistance of an identified faculty member as project guide during the first week of the seventh semester.

The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

Each student shall maintain a project work book. At the beginning of the project, students are required to submit a project plan in the project book. The plan should not exceed 600 words but should cover the following matters.

- ❖ Relevance of the project proposed
- ❖ Literature survey
- ❖ Objectives
- ❖ Statement of how the objectives are to be tackled

- ❖ Time schedule
- ❖ Cost estimate

These proposals are to be screened by the evaluation committee (EC- minimum of 3 faculty members including the guide) constituted by the head of department, which will include a Chairman and the EC will evaluates the suitability and feasibility of the project proposal. The EC can accept, accept with modification, request a resubmission, or reject a project proposal.

Every activity done as part of project work is to be recorded in the project book, as and when it is done. Project guide shall go through these records periodically, and give suggestions/comments in writing in the same book.

The students have to submit an interim report, along with project work book showing details of the work carried out by him/her and a power point presentation at the end of the 7th semester to EC. The EC can accept, accept with modification, request a resubmission, or extension of the project.

The student's internal marks for project will be out of 50, in which 30 marks will be based on day to day performance assessed by the guide. Balance 20 marks will be awarded based on the presentation of the project by the students before an evaluation committee consists of a minimum of 3 faculty members including the guide.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CE010 801 ADVANCED STRUCTURAL DESIGN

Teaching scheme: **Credit: 4**
3hours lecture and 2 hours tutorial per week

Objective:

*To familiarize students with behavior and design procedure of some of the special
structural elements so that they can perform better in the analysis and design of these
structures in practical situations.*

Module 1 (15 Hrs)
Road bridges: IRC Loadings and Specifications-T beam bridges – box culvert
 (Design forIRC Class A Loading only)- Bearings(Theory only)

Module 2 (15 Hrs)
Shell structures: general principles for membrane theory for symmetrical uniformly
distributed load- design of a simply supported single barrel cylindrical shell for
membrane stresses. Folded plates: general principles- structural behaviour of plates
(design not required)

Module 3 (14 Hrs)
Industrial buildings: roof loads- design of trusses (analysis not required) -design of
purlins-design of bracings and supporting system. (Problems not expected.)

Module 4 (15 Hrs)
Design of Plate girders and gantry girders- welded compound sections

Module 5(16 Hrs)
Steel bridges: IS specifications-design of highway and railway bridges of plate girder
type.(Design of bracings not required.)
Note:
Sketches only required for reinforcement details. Detailed drawing in drawing sheets
not required.

REFERENCES
1. IRC Bridge code,Indian railway bridge code, IS 456.IS 800,IS 875
2. Victor J D, Design of concrete bridges, oxford & IBH publishing
   company,new delhi
3. Krishna Raju, Advanced design of concrete structures, oxford & IBH
   publishing company,new delhi
4. Ramchandra, Design of steel structures vol 2 standard book house, delhi
5. Ramaswamy G S Design and construction of concrete shell roofs, Mc Graw
   Hill

CE010 802   BUILDING TECHNOLOGY AND MANAGEMENT

Teaching scheme: **Credits: 4**
2 hours lecture and 2 hours tutorial per week

Objective: *To impart theoretical knowledge as well as awareness to practical concepts in project implementation giving emphasis on three essentials of project management; (1) avoiding time over-run, (2) avoiding cost over-run, (3) maintaining total quality management*

Module 1 (12 Hrs)
Concrete Mix Design: General concepts. BIS method of mix design, American standards of mix design, IS-method of mix design, Durability concepts in mix design - Requirements and tests of materials required for mix design.-Fibre reinforced concrete- High performance concrete.
Form work. General arrangements – general requirements – common faults – materials for form work – form work arrangements – form work design – loads on forms – design procedure – form work vibration for compaction of concrete – stripping time and shoring.

Module 2 (12 Hrs)
Prefabricated construction: Advantages, foundation units, wall panels, frames for opening, walls–units for roofs and floors – low cost roof systems. Hollow concrete blocks, Ferro cement – use and application – modular co-ordination – method of production – flow line method – station method – manufacturing process for structural units.
Codification and Standerdisation- Value analysis: Various methods and techniques. Cost time analysis in Network Planning.

Module 3 (12 Hrs)
Construction company organization: Different types of organizational set up – construction team – objectives of civil engineering management – duties and responsibilities of a civil engineer – functions of construction management. Technical planning.
Site organization: Organization of labour, resources, materials, method of execution of the project – inspection and quality control- safety in construction.

Module 4 (12 Hrs)
Materials Management: Functions of materials management – inventory control techniques.
Construction contracts: Item rate contract – Lump-sum contract –Labour contract – Negotiated contract – Global contract – Percentage contract – Cost plus percentage contract- Cost plus fixed fee contract- Cost plus fluctuating fee contract – Target contract – All in contract.

Module 5 (12 Hrs)
Claims manual for a construction organization: Law of contract - Extra work and deviation order – claims – owner' s claim – sub contractor' s claim – disputes and arbitration – consequences of mistake in contracts – terms and conditions of contract – contract documents – earnest money – security deposit – warranty period – contract signed under coercion – contract signed by minors, insane or drunken persons – authority to agree and find, validity of an oral agreement – conditions and warranties – express terms and implied terms – voidable contracts and their performance – illegal and voidable contracts – liability for tort in contract- litigation – breach of contract and remedies – discharge of contract – equity, privity of contract – transfer of contractual rights and obligations.

References
1. Gambhir. M. L, Concrete Technology, Mcgrawhill
2. M .S Shetty, concrete technology, S. Chand & Co.
3. A.R Santhkumar-Concrete Technology-Oxford University Press
4. S. P Arora, Building constructions, Dhanpat Rai & sons, New Delhi.
5. B. L Gupta, Amit Gupta, Construction Management and accounts, standard publishers and Distributions.
6. Construction Management and accounts – V .N Vazirani.
7. Construction Engineering & Management, S. Seetharaman, Umesh Publications, Delhi.
8. Donald S Barrie & Boyd C Paulson - Professional Construction Management, Mc Graw Hill
9. P.S. Gahlot & B.M.Dhir , Construction Planning and Management, New agw International
10. Knatson, Conctruction Management fundamentals, McGraw Hill.

CE010 803   ENVIRONMENTAL ENGINEERING - II

Teaching scheme: **Credits: 4**

2 hours lecture and 2 hours tutorial per week

Objective:

- *To understand the basic principles of Wastewater Engineering*
- *To develop knowledge in unit operations and design of wastewater treatment systems*

Module 1 (10hrs)

Introduction to sanitary engineering. Sewerage systems – separate, combined and partially combined systems.

Quantity of sewage: sanitary sewage - sources, factors affecting. Fluctuations in sewage flow, peak factor.

Characteristics of sewage: physical, chemical and biological characteristics and analysis. population equivalent, relative stability.
Storm sewage: Factors affecting, intensity of rainfall, rational and empirical formula, time of concentration, intensity - duration curve and formula.

Design of sewers: Flow formula, minimum and maximum velocity of flow, effect of variation of discharge on velocity, use of partial flow diagrams, design of circular sewers, longitudinal and cross section of sewer lines.

Module 2 (10hrs)

Construction of sewers: Materials of sewers, crown corrosion.

Sewer appurtenances: inlets, catch basins, clean outs, manholes, drop manholes, lamp holes/flushing tanks, grease and oil traps, inverted siphons, storm regulators.
Sewage pumping: classification and capacity of pumps.

Natural methods of wastewater disposal: land disposal -. Sewage farming - disposal by dilution - self purification of streams - oxygen sag curve - dilution into sea, comparison of disposal methods.

Module 3 (10hrs)

Objectives of waste water treatment - Effluent standards, KSPCB Standards, BIS Standards. **Layout** of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general.

Screens - types of screens, design, disposal of' screenings; comminutors. **Grit chamber** - function, design, construction and operation, disposal of grit, detritus tank. **Skimming tank** -function, design and operation, disposal of skimmings **Sedimentation**: Theory of sewage sedimentation - design, construction and operation, rectangular and circular tanks, disposal of sludge.

Module 4 (15hrs)

Biological process: principle and theory of biological treatment**.** Sewage filtration: **Trickling filters** - design, construction and operation. **Activated sludge process**: Design, construction and operation of conventional and extended aeration, aeration methods. **Miscellaneous methods**- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors; disinfection of sewage effluents.

Module 5 (15hrs)

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. **Septic Tanks**: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks. Sewage treatment by **high rate anaerobic methods**: Anaerobic digestion, suspended growth, contact process, UASB, attached growth, filters, expanded bed - only basics.

References

1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
3. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
4. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.
5. Metcalf & Eddy, Waste water Engg.- Treatment and Reuse, 4th Edn., Mc Graw Hill International Editions.
6. Mark J Hammer, Water and waste water technology, John Wiley and sons, Inc.

CE010 804L01 ADVANCED FOUNDATION DESIGN (Elective III)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective:
After acquiring the basic knowledge in soil mechanics and foundation engineering, this course is offered as an elective with the objective of giving in depth knowledge in the design of foundations for different structures and in difficult soils.

Module 1 (12 hrs)
Well foundations: Introduction- Applications-Different shapes of wells-grip length-scour depth-design depth-forces acting on well foundation-Terzaghi's method of analysis (only general case)-bearing capacity based on N value(only IS recommendation)-design of individual components of well-sinking of wells-measures for rectification of tilts and shifts. Features of Box(floating) caisson and pneumatic caisson

Module 2 (12 hrs)
Soil dynamics and Machine foundations: Introduction- Soil behavior under dynamic loads and application-Difference between static and dynamic load behavior-soil properties relevant for dynamic loading- free vibrations and forced vibrations- determination of dynamic soil constants in laboratory and field based on IS code provisions Types of machines-Types of machine foundations -vibration analysis of a machine foundation-general design criteria for machine foundations- Design criteria for foundation for reciprocating machines(only IS specifications) -vibration isolation and control

Module 3 (12 hrs)
Sheet Pile walls and Cofferdams: types and uses of sheet piles-design of cantilever sheet pile walls in granular and cohesive soils-anchored bulkhead-free earth support and fixed earth support method-coffer dams-uses- braced and cellular cofferdams
.
Module 4 (12 hrs)
Special Foundations: Foundation for special structures such as water tanks, silos, cooling towers, guyed structures, ground storage tanks, chimneys, telecommunication towers, transmission line towers-foundation for under ground conduits- foundation for coastal and offshore structures-pre-stressed foundations. Shell Foundations-structural form and efficiency-different types.

Module 5 (12 hrs)
Foundations in Special soils: Foundation in expansive soil, soft and compressible soils, problems associated with foundation installation- ground water lowering and drainage- shoring and underpinning-different methods-damage and vibrations due to constructional operations

References

1. Bowles.J.E, Foundation Analysis and DesignMc Graw Hill Publishing Company.
2. N.P.Kurian, Modern foundations Tata Mc Graw Hill Publishing company
3. Srinivasulu P, Vaidyanathan C.V Handbook of Machine foundations
4. 11Teng W.C., *Foundation Design*, PHI
5 . P.C.Varghese, Foundation Engineering,Prentice-Hall of India Private Ltd, New Delhi
6 . Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill
   P ublishing Compay Limited,New Delhi.
7. Leonards G.A., *Foundation Engineering*, McGraw Hill
8   Arora K.R., *Soil Mechanics & Foundation Engg.,* Standard Publications
9   Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
10. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
11   Teng W.C., *Foundation Design*, PHI
12. Tomlinson M.J., *Foundation Design & Construction*, Pitman
13 .Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education
   University of Calicut

CE010 804L02 ENVIRONMENTAL GEOTECHNIQUES (Elective III)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective:
Waste disposal is a major issue for which we need different effective and innovative methods. The objective is to familiarise the students, the different types of wastes generated , composition of the wastes, and the problems they pose on environment due to improper disposal. It also includes the different effective methods for the disposal for the different types of wastes.

Module 1 (12 hours)
Clay mineralogy and soil structure: Gravitational and surface forces-inter sheet and inter layer bonding in the clay minerals- Basic structural units of clay minerals- isomorphous substitution – kaolinite mineral- montmorillonite mineral -illite mineral- electric charges on clay minerals – base exchange capacity ,diffused double layer- adsorbed water- soil structure- methods for the identification of minerals (introduction only).

Module 2 (15 hours)
Effect of environment on Geotechnical properties of soils: Effect of drying on Atterberg limits.-Volume change behaviour- factors controlling resistance to volume change- general relationship between soil type, pressure and void ratio.- importance of mineralogical composition in soil expansion. Activity- sensitivity ,causes of sensitivity-Influence of exchangeable cations , pH and organic matter on properties of soils. Permeability of soils- hydraulic conductivity of different types of soils – Darcy' s law and its validity- factors affecting permeability

Module 3 (10hours)
Wastes and Contaminants (introduction only): sources of wastes-types of wastes composition of different wastes- characteristics and classification of hazardous wastes- generation rates- ground water contamination- sources of ground water contamination- transport mechanisms-potential problems in soils due to contaminants.

Module 4 (12 hours)
Disposal and containment technics: Criteria for selection of sites for waste disposal- hydrological aspects of selection of waste disposal sites- disposal facilities- subsurface disposal technics-disposal systems for typical wastes (sketches only)

Module 5 (12 hours)
Containment control systems-Liners and covers for waste disposal- rigid liners, flexible liners. Ground modification technics in waste management – waste modification- ground modification- mechanical modification-hydraulic modification- chemical modification.

References
1. Mitchell, J (1976), " Fundamentals of soil behaviour", John Wiley and sons,
   NewYork
2. Lambe, T. W & Whitman, R. V (1979), " Soil Mechanics ", John Wiley and Sons,
   New York.
3. Gopal Ranjan & A.S.R Rao (1991), " Basic and Applied Soil Mechanics, Wiley
   Eastern Ltd., New Delhi.
4. Wilson, M. J (1987), " A Hand book of Determinative methods in Clay
   Mineralogy", Chapman and Hall, New York.
5. Robert M. Koerner (1984), "Construction and Geotechnical methods in
   Foundation Engineering", McGraw Hill Book Co., New York.

CE010 804L03   EARTHQUAKE ENGINEERING AND DESIGN (Elective III)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective: *To have a general awareness about effects of earthquake and study of seismic design of structures.*

Module 1 (9 hrs)
 Causes of Earthquakes: The earth and its interior, the circulations, plate tectonics. Types of earthquakes.
 Seismic waves, measuring instruments, locating focus of earthquakes from wave velocity strong ground motions, characteristics of strong ground motion, magnitude, intensity and energy release. Direct and indirect effects of earthquake.

Module 2 (8 hrs)
Past earthquakes in India, basic geography and tectonic features of India, seismic zones of India.
Inertia forces in structures, flow of inertia, forces to foundations, effect of deformation in structures.
Building forms for earthquake resistance, Architectural features, size of buildings, horizontal and vertical layout of buildings.

Module 3 (14 hrs)

Torsion in buildings, Rigid and flexible floor diaphragm, Torsionally coupled and uncoupled system, earth design philosophy. importance of ductility, capacity design concept-Strong column weak beam concept, weak storey, flexibility of long and short period structures.

Module 4 (16 hrs)

Equivalent static lateral earthquake force analysis based on IS: 1893-2002, capacity design and detailing of R.C. building.
Flexible and rigid floors. Role of shear wall, load distribution among shear walls.

Module 5 (13 hrs)

Behaviour of brick masonary walls, Box action of masonary buildings, role of horizontal and vertical bands, retrofitting techniques of R.C.C. and masonry Buildings.

References
1. Earthquake resistant design of structures, P. Agarwal and. **M.**Shrikande, PHI Learning
    Pvt. Ltd., New Delhi
2. Earthquake resistant Design of structures, S.K. Duggal, Oxford University Press, New
    Delhi

3. Geo technical Earthquake Engineering, S. L. Kramer, Pearson Education.

4. Earthquake Tips, C. V. R. Murthy, BMTPC, New Delhi

5. Bureau of Indian Standards
   I S: 1893(Part I 2002)
   I S: 113920-1993
   I S: 13935-1993
   I S: 13828 -1993

6. Earthquakes, Bruce A. Bolt, W. H. Freeman & Company

7. Basic Geotechnical Earthquake Engineering. Dr.Kamalesh Kumar, New age
   International Pvt. Ltd.l

CE 010 804L04 ADVANCED HYDROLOGY AND SYSTEM ANALYSIS
(Elective -III)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective: *To increase knowledge on the application of advanced hydrologic methods to water resources problems. Hydrologic analysis emphasizes computational methods in hydrology for specific tasks. The level of understanding should, upon completion of the course, be sufficient to understand and appreciate the important issues in the current literature where statistical and optimization methods are used in prediction and interpretation of hydrologic processes.*

Module 1 (10hrs)
Introduction: Hydrologic cycle- Weather and hydrology: Thermal circulation - effects of earth's rotation - effect of' land and water distribution - migratory systems - fronts - measurement of temperatures –- geographic distribution of temperatures - time variations of temperatures - properties of water vapour- Measurement of humidity – geographic distributions of humidity - time variations in humidity-geographic variations of wind - time variations of wind - scanning and predicting weather.

Module 2 (10 hrs)
Precipitation: Measurement of precipitation- recording gauges - automatic gauges radars - estimation of missing data and adjustment of records - mean areal depth of precipitation - rain gauge network- design principles-depth area duration curves – Hyetograph, hydrograph and mass curve of rainfall - analysis of rainfall data - moving average curves - design storms – probable maximum precipitation curves snowfall and measurement. Determination of snow melts. Water Losses: Evaporation-evaporation pans – evapometre, control of' reservoir evaporation - soil evaporation - transpiration - estimation of evapo transpiration - infiltration - infiltration curves - determination of infiltration indices - water shed leakage - water balance.

Module 3 (10 hrs)
Runoff: Catchments characteristics - classification of streams- run off estimation by empirical formulae, curves, infiltration method, rational method, overland flow hydrograph and unit hydrograph method.
Hydrographs**:** Separation of stream, flow components - - unit hydrograph - assumption - derivations of unit hydrograph - unit hydrograph of complex storms - instantaneous unit hydrograph - synthetic unit hydrograph-applications.

Module 4 (15hrs)
Floods: Definition of standard project flood –Frequency analysis- maximum probable flood – probable maximum precipitation and design flood - estimation of peak flood-flood control. Measures - flood forecasting techniques- flood routing - analytical and graphical methods of flood routing. The erosion process - factors controlling erosion - reservoir sedimentation - control of reservoir sedimentation.

Module 5 (12 hrs)
System analysis: Basic system analysis concepts, scope and steps in system engineering-system approach-need for system approach-concept of models-classification of models-General system model, Descriptive vs Predictive, Single vs Multiple events and Stochastic vs Deterministic Models-simulation models- applications

Probability analysis of hydrological data**:** mean, median, mode, mean-deviation, standard deviation, variances and skewness of data normal, gamma, poisons, log normal and pears and type III distributions - flood, frequency by fuller's, Gumbel's, Powel and Ven Te chow methods.
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References
1. H. M.Reghunath, Hydrology, Wiley Easten Ltd., New Delhi.
2. Santhosh Kumar Garg, Hydrology and flood control engineering, Khanna Publishers.
3. R.K. Linsley, M. A. Kholar, Hydrology for engineers, Tata Mc Graw Hill.
4. Ven Te Chow, Maidment, D. R., and Mays, L. W., Applied Hydrology, McGraw-Hill, 1988.
5. Vijay P. Singh, Elementary Hydrology, Prentice Hall, 1992.
6. Viessman and lewis, introduction to hydrology, Harper Collin college publisher, 1996
7. Nathabandu T. Kottegoda and Renzo Rosso, Statistics, Probability, and Reliability for Civil and Environmental Engineers, The McGraw-Hill Companies, Inc., 1997.
8. Alfredo H.S. Ang and Wilson H. Tang, Probability Concepts in Engineering Planning and Design Vol. I Basic Principles and Vol. II Decision, Risks and Reliability, Wiley, 1975.
9. D.R. Helsel and R.M. Hirsch, Statistical Methods in Water Resources, USGS, 2002, http://pubs.usgs.gov/twri/twri4a3/.
10. C. T. Hann, Statistical Methods in Hydrology, The Iowa State University Press, 1977.
11. George P. Box and Gwilym M. Jenkins, Time Series Analysis: Forecasting and Control, Holden Day, 1976.

CEO10 804L05 HIGHWAY AND AIRFIELD PAVEMENTS (Elective III)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective:
To equip the students to carry out design and evaluation of flexible and rigid pavements in varied field conditions.

Module 1 (12hrs)
Pavement types: stress distribution in pavements - theoretical subgrade conditions and traffic loadings Basic difference between flexible and rigid pavements - design factors - wheel load - equivalent single wheel load - repetition of loads - elastic modulii - climatic variations.

Module 2 (12hrs)
Design of flexible pavements: group index method - CBR method - IRC recommendations - Me Load method - Burmister's layer theory.

Module 3 (12hrs)
Design of rigid pavements: radius of relative stiffness - critical load positions - Westergaard's stress equation - Bradley's stress coefficients - design charts.

Module 4 (12hrs)
Temperature stresses in concrete pavements: Westergaard's concept - wrapping stress - functional stress - combination of stresses.
Design of joints in concrete pavements: expansion joints - construction joints - design of dowel bars - tie bars - IRC recommendation.

Module 5 (12hrs)
Evaluation of pavement condition: pavement instrumentation - types of pavement distress - roughness and skid resistance. Environmental influence and effects-pavements maintenance and overlays.

References
1. Bindra B.S, Highway Engineering, Danpat Rai and Sons.
2. H.J.Yoder, Principles of Pavement Design, John wiley and sons
3. Khanna O.P, Justo C.G., Highway Engineering, Nem Chand Publishers
4. IRC Standard specifications for Construction of Flexible and rigid pavements

CE010 804 L06 STRUCTURAL DYNAMICS AND STABILITY ANALYSIS
(Elective III)

Teaching scheme: **Credit: 4**
  2 hours lecture and 2 hours tutorial per week

Objective:
  To study 1. the basic concepts of stability.
             2.the comprehensive methods of dynamic analysis.

Module 1 (12 hours)
Introduction-problems in nature-steady state problem-dynamic problem-stability
problem (Eigen value problem)-introduction to dynamic loading-D'Alembert' s
equation of equilibrium-inertia force-effect of damping-Hamilton' s principle.

Module 2 (12 hours)
Single degree of freedom system-idealisation-free vibration-natural frequencyresonance-
forced vibration-lumped mass-consistent mass.
solution techniques-determinant search procedure-Householders method

Module 3 (12 hours)
Introduction to stability analysis-energy principles-stable, unstable and neutral
equilibrium-fourth order differential equation for generalized bending problemselastic
instability of columns-Euler' s theory-assumptions-limitations. General
treatment of column stability problem as an Eigen value problem-various modes
of failure for various end conditions- both ends hinged-both ends fixed-one end
fixed other end free- one end fixed other end hinged

Module 4 (13 hours)
Beam column-beam column equation-solution of differential equation for various
lateral loads-udl and concentrated loads-solutions for various end conditions-both
ends hinged-both ends fixed-one end fixed other end free- one end fixed other end
hinged.

Module 5 (11 hours)
Finite element application to dynamics-element stiffness matrix and mass matrix
of a beam element. Finite element application to stability analysis- finite element
stability analysis-element stiffness matrix –geometric stiffness matrix-derivation
of element stiffness matrix and geometric stiffness matrix for a beam element.

References
1. Ray W Clough, Joseph Penzien, Dynamics of structures, Mc Graw Hill,Kogabusha
Ltd.
2. Ziegler H, Principles of structural stability, Blarsdell, Wallham, Mass, 1963.
3. Thompson J M, G W Hunt, General stability of elastic stability, Wiley, NewYork.
4. Timoshenko, Gere, Theory of elastic stability, Mc Graw Hill, New York.
5. Don O Brush, B O O Almorth, Buckling of Bars, plates and shells,
6. Cox H L, The buckling of plates and shells, Macmillam, New York, 1963.
7. O C Zienkiewicz ,.Finite Element Method ,fourth Edition,McGraw Hill,
8. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley&Sons.

CE010 805G01   FINITE ELEMENT ANALYSIS (Elective IV)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objective:
To make the back ground, basic concepts and basic formulation of finite element method

Module I (12hrs)
Introduction to FEM-Historical development-Idealization of actual structures-
Mathematical model-General procedure of FEA-Displacement approach. Solution
techniques- Gauss Elimination – Frontal solver (concepts only)

Module 2 (12hrs)
Finite element analysis- -Energy principles- Principle of Stationary Potential
Energy- Complementary Energy - Variational approach -Stable- Unstable-
Neutral equilibrium-Virtual work- Principle of virtual forces – Principle of virtual
displacements.

Module 3 (12hrs)
Shape functions-Lagrangian and Hermition Interpolation – Polynomials – General
coordinates-Area coordinates-Compatibility –C_0 and C_1 elements-convergence
criteria- conforming & nonconforming elements – Patch test

Module 4 (12hrs)
Stiffness matrix-Bar element-Beam element-Triangular elements - Constant
Strain Triangle-Linear Strain Triangle- Isoparametric elements-Numerical
Integration - Gauss Quadrature.

Module 5 (12hrs)
General plate bending elements- Plate bending theory – Kirchhoff's theory –
Mindlin's theory – Introduction to locking problems- preventive measures –
reduced integration – selective integration. Axysymmetric elements- Introduction
to shell elements

References
1. O C Zienkiewicz,.Finite Element Method, fourth Edition,McGraw Hill,
2. R.D.Cook, Concepts and Applications of Finite Element Analysis, John Wiley
    &Sons.
3. Stephen P.Timoshenko& Krieger, S.W., Theory of Plates and Shells, McGraw
    Hill.
4. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw Hill .New Delhi,
    1987.
5. S.Rajasekharan, Finite Element Analysis, Wheeler Publishing Co., &Sons.1993.
6. T.Kant, Finite Element Methods in Computational Mechanics, Pergamons Press.
7. K.J.Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,
8. Mukhopadhyay M., Matrix Finite Element Computer and Structural Analysis,

Oxford &IBH, 1984.

9. Irving H.Shames, Energy &Finite Element Methods in Structural Mechanics.

10. Desai C.S.&Abel J.F., Introduction to Finite Element Methods, East West Press

CE010 805G02 ENVIRONMENTAL POLLUTION CONTROL TECHNIQUES
(ELECTIVE IV)

Teaching scheme: **Credit: 4**
    2 hours lecture and 2 hours tutorial per week
Objective:
- o *To understand the basic concept of various forms of Environmental Pollution*
- o *To develop knowledge in control techniques for Environmental Pollution*

Module 1 (12hrs)

Introduction to environmental pollution

Air pollution – Sources – Criteria pollutants – Control of gaseous pollutants (adsorption, absorption, reaction and other methods) – Control of particulate pollutants (settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators)– Automobile pollution control

Module 2 (12hrs)

Water pollution – Sources – Various Pollutants – Treatment and control methods – Physico-chemical and Biological Treatments – Screening, skimming, sedimentation, coagulation, Filtration, Trickling Filters, Activated sludge process, Oxidation ponds, high rate anaerobic methods (design not needed)

Module 3 (12hrs)

Industrial Pollution - Characteristics of industrial wastes**:** physical, chemical and biological. Pretreatment of industrial wastes**:** waste volume reduction, waste strength reduction - neutralization, equalization and proportioning.
Theories of treatments processes**:** sedimentation flotation coagulation - evaporation & ion exchange – lagooning - activated sludge treatment - High rate anaerobic treatment.

Module 4 (12hrs)

Solid waste management: Type and source of solid waste, characteristics, collection, transportation and processing- Waste minimization strategies – Reduction - Recycling – Reuse – Disposal - composting, sanitary landfill, incineration, .

Module 5 (12hrs)

Noise pollution: Sources, effects of noise pollution, control measures.
Administrative and Legislative control of environmental pollution. Important
Environmental rules and regulations, environmental protection laws and acts.

References
1. Peavy, Rowe, Tchobanoglous, Environmental Engineering, Mc Graw Hill International Editions.
2. M.N. Rao & H.V.N. Rao, Air Pollution, Tata Mc Graw Hill Pvt. Ltd., New Delhi.
3. S. K. Garg, Environmental Engineering Vol. l & ll, Khanna Publishers, New Delhi.
4. B.C. Punmia, Water supply Engineering, Arihant Publications, Jodpur.
5. B.C. Punmia, Waste water Engineering, Arihant Publications, Jodpur.
6. Nelson Leonard Nemerow, Theories and practices of industrial waste treatment, Addison-Wesley Publishing Co., Inc.

7. W Wesley Eckenfelder Jr., Industrial water pollution control, International Edition, Mc Graw Hill Inc, New Delhi.
8. M Narayana Rao, Waste water treatment, Rational methods of design and Industrial practice, Oxford & IBH Publishing Co. Pvt. Ltd, Bombay.
9. C.S. Rao, Environmental Pollution Control Engineering, New Age International (P)Ltd, New Delhi.
10. Warren Viessman and mark J Hammer, Water Supply and Pollution Control, Pearson Education, Inc.
11. Gilbert M.Masters, Kurian Joseph and R. Nagendran, Introduction to Environmental Engineering and Science.
12. Ruth F. Weiner and Robin Matthews, Environmental Engineering, Butterworth-Heinemann, Elsevier.

CE010 805G03   OPTIMIZATION TECHNIQUES (Elective IV)

Teaching scheme: **Credit: 4**
  2 hours lecture and 2 hours tutorial per week
Objective:

   To make the students aware of scientific methods and techniques to decision making problems and provides the best optimal solutions.

Module 1 (12hrs)
Classical optimization techniques
Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimization with equality constraints – Lagrange multiplier method - Multivariable optimization with inequality constraints – Kuhn-Tucker conditions.

Module 2 (12hrs)
One-dimensional unconstrained minimization
Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.

Module 3 (12hrs)
Unconstrained minimization
Gradient of a function – Steepest descent method – Newton's method – Powells method – Hooke and Jeeve's method.

Module 4 (12hrs)
Integer – Linear programming problem
Gomory' s cutting plane method – Gomory' s method for all integer programming problems, mixed integer programming problems**.**

Module 5 (12hrs)
Network Techniques
Shortest path model – Dijkstra`s Algorithm – Floyd`s Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm.

References
1. S.S. Rao, Optimization theory and application, New Age International P. Ltd.
2. A.D. Belegundu, T.R. Chandrupatla, Optimization Concepts and applications in Engineering, Pearson Education Asia.
3. F. S. Budnick, D. McLeavey, R. Mojena, Richard D, Principles of Operations Research for Management, Irwin, INC.
4. H. A. Taha, Operation Research an introduction, Eastern Economy Edition.
5. R. Panneerselvam, Operations Research, PHI.

CE010 805G04   LAND USE PLANNING (Elective IV)

Teaching scheme: **Credit: 4**
2 hours lecture and 2 hours tutorial per week

Objectives:
The basic objective of this course is to introduce to the students of planning the various theories of planning and city design along with necessary details in terms of population projection, formulation of activity structure, formulation of goals and objectives for any planning work to be carried out. This course is also aimed at students getting enough theoretical background to carry concurrent laboratory exercise in area planning and city planning. Attempt has been made to include several case studies and relate them to the theories of planning to develop better understanding of urban planning.

Module 1 (10 Hrs)
Introduction: Brief Study of Urban Travel Patterns and Urban Transportation Technologies; Land use-Transportation Planning Process

Module 2 (13 Hrs)
Urban Forms and Urban Structure: Hierarchy of Urban Activity System, Hierarchy of Urban Transportation Network and Technology; Relationship between Movement and Accessibility Functions of Transportation Network; Urban Structure and its Characteristics such as Centripetal, Grid Iron, Linear and Directional Grid types, Study of Urban Forms such as Garden City, Precincts, Neighbourhoods, Linear City, MARS Plan, LeCorbusier Concept, Radburn Concept, Environmental Area Concept.

Module 3 (13 Hrs)
Demographic and Employment Forecasting Models: Demographic Models- Linear, Exponential and Logistic Models,; Cohort Survival Models-Birth, Aging and Migration Models; Employment Forecasting Models- Economic base Mechanism; Population and Employment Multiplier Models- Input and Output Models - Dynamic Models of Population and Employment

Module 4 (12 Hrs)

Land use-Transportation Models: Lowry based Land use-Transportation Models – Allocation Function, Constraints, Travel Demand Estimation – Iterative Solutions, Matrix Formulation

Module 5 (12 Hrs)

Evaluation of Land use – Transportation Plans: Operational, Environmental and Economic Evaluation – Concept of Demand and Supply for Transportation Projects – Benefit and Cost – B/C and Cost Effective Approach for Economic Evaluation.

References
1) Hutchinson B.G., Principle of Transportation Systems Planning, McGraw-Hill.
2) Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall.
3) Dickey J.W., *et. al*., Metropolitan Transportation Planning, Tata McGraw-Hill.
4) Gallion A.B and Eisner S., The Urban Pattern, Affluated East-West Press, New Delhi.
5) Heggei, I.G., Transportation Engineering Economics, Mc-Graw Hill Book Company, New York.
6) Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons.

CE 010 805G05 NUMERICAL METHODS (Elective IV)

Teaching scheme: Credit: 4
2 hours lecture and 2 hours tutorial per week

Objective
    To impart the basic concepts of mathematical modeling of problems in science and engineering and to know procedures for solving different kinds of problems.
    To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.

Module I (10 hours)
Solution of linear equations:- Review of Gaussian elimination and Cholesky methods- storage schemes – substructure concept- sub matrix equation solver

Module 2 (12 hours)
Solution technique for Eigen value problem:- Introduction – forward iteration, inverse iteration, Jacobi's method

Module 3 (13 hours)
Numerical Interpolation& Integration – Introduction – Lagrange, Hermitian and isoparametric style of interpolation. Numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Gauss quadrature formula – weights and Gauss points

Module 4 (12 hours)
Finite difference techniques:-Finite difference method, ,Newton's method, Variational and weighted residual methods

Module 5 (13 hours)
Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear regression

References
1. Balagurusamy E , *Numerical Methods*, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
2. Gerald C.F. and Wheatley P.O., *Applied Numerical Analysis, 6th Ed.*, Pearson Education Asia, New Delhi, 2002.
3. Rajasekharan S, Numerical Methods in Science and Engineering, A practical Approach, A.H. Wheeler &Co
4. K.J. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall,
5. Jain M.K., Iyengar S.R.K. &Jain R.K, Numerical Methods for Science and Engineering, Prentice Hall of India
6. Saumyen Guha& Rajesh Srivastava, Numerical Methods for Engineering and Science, Oxford University Press.

CE010 805G06 REMOTE SENSING AND GIS APPLICATIONS (Elective IV)

Teaching scheme   **Credit: 4**
 2 hours lecture and 2 hours tutorial per week.

Objective

To make the students aware of the technological developments in the geographical database management and its advantages.

Module 1 (**13hours**)

Remote sensing: definition- components of remote sensing- energy sensor, interacting body- active and passive remote sensing- platforms- Arial and space platforms- balloons, helicopters, aircrafts and satellites- electromagnetic radiation(EMR)- EMR spectrum- visible, infrared(IR) ,near IR, middle IR, thermal IR and microwave- black body radiation- Plancks Law- Stefan- Boltzman law.

Module 2 (**12hours**)

Atmospheric characteristics- scattering of EMR- Raliegh, Mie, Non-selective and Raman scattering- EMR interaction with water vapour and ozone- atmospheric windows- significance of atmospheric windows- EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy- reflectance- specular and diffused reflection surfaces- spectral signature- spectral signature curves- EMR interaction with water, soil and earth surface.

Module 3 (**12hours**)

Optical and Microwave Remote sensing:

Satellites- classification- based on orbits- sun synchronous and geo synchronous- based on purpose- earth resources satellites, communication satellites, weather satellites, spy satellites- satellite sensors- resolution- spectral, spatial, radiometric and temporal resolution- description of multi-spectral scanning- along and across track scanners- description of sensors in IRS series- current satellites- radar- speckle- back scattering- side looking air borne radar- synthetic aperture radar- radiometer radar- geometrical characteristics. Principles of thermal remote sensing- Principles of microwave remote sensing.

Module 4 (**12hours**)

Geographic information system- components of GIS- hardware, software and organizational context- data- spatial and non spatial maps- types of maps- projection- types of projection- data input- digitizer, scanner, editing- raster and vector data structures- comparison of raster and vector data structure- analysis using raster and vector data- retrieval, reclassification, overlaying, buffering- data output- printers and plotters.

Module 5 (12hours)

Miscellaneous topics: interpretation of satellite images- elements of interpretation- visual interpretation- digital image processing techniques- image enhancement- filtering- image classification- FCC composites- supervised and unsupervised integration of GIS and remote sensing- application of remote sensing and GIS- urban applications- water resources- urban analysis- watershed management- resources information system- hazard mitigation.

References:

1. Thomas M.Lillesand &Raiph W.Kiefer,"remote sensing and image interpretation",John Wiley Sons.
2. Floyd F. Sabins, "Remote sensing principles and interpretation", Freeman And Company.
3. Anji Reddy,"Remote sensing and geographical systems",BS Publications.
4. M.G.Srinivas (Edited by),"Remote Sensing Applications", Nerusa publications.
5. Jensan J.R.,"Introductory Digital Image Processing",Prentice Hall of India.

CE010 806   ENVIRONMENTAL ENGINEERING LAB

Teaching scheme   **Credits: 2**
3 hours practical per week

Objective:
To make students familiar with laboratory tests for water and waste water quality assessment.
List of Experiments

1. Determination of alkalinity of water.
2. Determination of hardness of water.
3. Determination of acidity of water.
4. Determination of iron.
5. Determination of sulphates.
6. Determination of Chlorine demand and residual chlorine.
7. Determination of chlorides in water.
8. M. P. N. of Fecal coliforms using A-l medium
9. D.O. and Biochemical Oxygen Demand.
10. Chemical oxygen demand.
11. Determination of solids - total, suspended, dissolved, fixed, volatile, settleable and SVI.
12. Determination of Turbidity and estimation of optimum coagulant dosage by jar test.
13. Determination of pH

Reference:
1. "Standard methods for the examination of water and wastewater" 1995, ALPHA, AWWA, WPCF Publication.
2. "Chemistry for Environmental Engineering"- Sawer and McCarty, McGraw Hill.
3. "Manual of standards of quality for Drinking Water Supplies"- Indian Council of Medical Research, New Delhi.
4. "International Standards of Drinking Water" – W.H.O.
5. "IS 2490-1981, IS 3306- 1974, IS 3307-1977, IS 7968-1976, IS 2296-1974, IS 10500-1991" Bureau of Indian Standards, New Delhi, Effluent Standard KSPCB.

CE010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CE010 808　　　Viva -Voce

Teaching scheme　　　　　　　　　　　　　　　　　　**credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.