ELECTIVE-II (BCE405)

1. ADVANCED FOUNDATION ENGINEERING (3-1-0) CREDIT: 04

Module – I

Foundation subjected to Vibration :

Introduction, type of machine foundation, single degree freedom system, free and forced vibration with and without damping. Parameters influencing the design of machine foundation. Measurement of dynamic soil parameters.

Module – II

Sheet pile walls : Cantilever and anchored sheet pile walls, methods of analysis, Vertical cuts and ditches, earth pressure analysis,

Module – III

Coffer dams :Types, description

Floating foundation : Introduction, type methods to prevent floatation, necessity of using raft for full floating foundation.

Module – IV

Foundation on expansive soil : Shrinkage and expansion of clays, identification of expansive soil, swelling pressure measurement, causes and type of damages in building on expansive clays, Principles of design of foundation in expansive soil deposits.

REFERENCE BOOKS :

1. Handbook of Machine Founadtion, P. Srinivasulu and C.V Vaidyanathan, TMH, New Delhi
2. Foundation Engineering, P.C. Verghese, Prentice Hall of India
3. Textbook of Geotechnical Engineering, I. Q. Khan, Prentice Hall

2. Finite Element Method (3-1-0) Credits: 04

Introduction: The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method.

One and Two Dimensional Problems: Detail formulation including shape functions. stress strain relations, strain displacement relations and derivation of stiffness matrices using energy approach, Assembling of element matrices, application of displacement boundary conditions, Numerical solution of one dimensional problems using bar, truss, beam elements and frames. Derivation of shape function using Lagrange's interpolation, Pascal's triangle, Convergence criteria. Finite Element modeling of two dimensional problems using Constant strain Triangle(CST) elements, Stress strain relations for isotropic and orthotropic materials, Four nodded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

Isoparametric Elements: Natural coordinates, isoparametric elements, four node, eight node elements. Numerical integration, order of integration.

Plate Bending: Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modeling.

Dynamic Considerations: General Equation of motion, Lagrange's approach, mass matrix, lumped and consistent mass matrices, Evaluation of eigenvalue and eigenvectors, stability problems.

Essential Reading

1. R. D. Cook., Concepts and Applications of Finite Element Analysis , Wiley.
2. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill

Supplementary Reading

3. Logan, D. L., A First Course in the Finite Element Method, PWS Publishing, Boston,
4. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc Hill.

3. Computer Aided Design of Structures (3-1-0) Credits:04

Module-I
Introduction to CAD, Description of Computer hardware and software, Use of graphic terminal, various commands, Generation of points

Module-II
Various forms of lines including curved lines, 2D transformations, 3-D transformations, hidden line removal, Data base management, Application of graphics packages.

Module-III
Matrix method of structural analysis and associated computer programmes, Introduction to interactive computer programmes for design and detailing of structural elements, RCC slabs, beams, columns, isolated footings, etc.

Module-IV
Steel- Typical members and connection

Essential Reading

1. Computer Aided Design by C. S. Krishnamoorthy

4. Bridge Engineering (3-1-0) Credits:04

Introduction, historical review, engineering and aesthetic requirements in bridge design. Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning;. Scour - factors affecting and evaluation.

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs. Girder bridges - types, load distribution, design. Orthotropic plate analysis of bridge decks.

Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of R.C Bridges, Prestressed concrete bridges and steel bridges Fabrication, Lounching & creation. Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

Reference Books

1. Jacoby and Davis, Foundation of Bridges and Building
2. Road bridges- IRS Sec –I , II, III
3. Dunhan, Foundation of Structures
4. Concrete association of India, Concrete bridges
5. Tylor, Thomson and Smulki, . R C Bridges
6. IRS Codes of Practice for Railway bridges

5. WATER POWER ENGINEERING (3-1-0) CREDIT: 04

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels.

Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house.

Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house.

Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

6. Computational Hydraulics (3-1-0): Credit-04

Ordinary and Partial differential equations, well-posed, ill-posed problem, Finite difference schemes, Stencil diagrams, basic aspect of discretization, truncation error, implicit and explicit types, accuracy, convergence, errors and stability analysis, Von Neumann method, CFL condition, some hydrodynamic techniques – Lax-Wendroff, MacCormack, Crank-Nicolson, staggered grid, ADI, ADE, pressure correction,

SIMPLE and SOLA algorithm, method of characteristics, finite element method. Variational and weighted residual formulations, applications to steady and unsteady flows, Pollutant dispersion, flood wave propagation, tidal model, applications with computer programming, etc.

References:

1. Computational Fluid Dynamics: John D. Anderson, Jr.
2. Computational Fluid Dynamics: T. J. Chung
3. Computational Fluid Mechanics and Heat Transfer: Series in Computational and Physical Processes in Mechanics and Thermal Sciences: John C. Tannehill, Dale A. Anderson and Richard H. Pletcher
4. Computational Methods in Surface/Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 1 & 2 : A.A. Aldama and J.Aparicio
5. Computational Methods in Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 2: A.A. Aldama and J. Aparicio
6. Computational Fluid Dynamics: Principles and Applications: J.Blazek