

VSS UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA
CIVIL ENGINEERING DEPARTMENT
CURRICULUM
For
B.TECH – 7TH SEM
THEORY

BCE 401 - CONCRETE STRUCTURES (3-1-0) CR-04

Module-I (10 Hours)

Introduction to EQ Engineering: Cyclic behavior of concrete and reinforcement, significance of ductility, ductility of beam, design and detailing for ductility, simple problems based on above concept, Computation of earthquake forces on building frame using Seismic Coefficient Method as per IS 1893-2002

Module-II (10 Hours)

Combined Footing: Design of Rectangular and Trapezoidal footing, Design of Raft Foundation

Module-III (10 Hours)

Retaining walls: Forces acting on retaining wall, Stability requirement, Design of Cantilever and Counterfort Retaining walls

Module-IV (10 Hours)

Building Portals: Analysis of portal frames, Design of Rectangular portal frames

Design of Water tanks: Design requirements, Design of tanks on ground and under ground.

Reference books

1. A K Chopra ,Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall of India
2. Advanced Concrete Structure Design by P. C. Verghese, Prentice Hall of India
3. Limit state design- A K Jain, Nem Chand and Brothers

BCE402-GEOTECHNICAL ENGINEERING – II (3-1-0) CR-04

Module – I (10 Hours)

Stress distribution in soil: Boussinesq equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, strip load, uniformly loaded circular and rectangular areas. Use of newmark's chart. Westergaard's solution. Approximate methods (point load method, two-to-one load distribution method). Contact pressure distribution due to loaded areas. Concept of active zone.

Module –II (10 Hours)

Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, Rebhann's and Culmann's graphical methods, stability conditions for retaining walls. Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, fiction circle method, Bishop's method. Use of Taylor stability number. Fellnious metod for locating centre of critical slip circle.

Module – III (10 Hours)

Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings), indirect (sounding, penetration tests, and geophysical methods).

Planning of exploration programme, spacing and depth of boring, soil sampling, types of samples, standard penetration test, static and dynamic cone penetration test, in-situ vane shear test. Seismic refraction method, electrical resistivity methods,

Module-IV (10 Hours)

Shallow foundation: Introduction, bearing capacity, methods and determination of bearing capacity, settlement of foundations.

Deep foundation: Classification of pile, pile driving methods, pile capacity (static and dynamic analysis) pile-group analysis, load test on piles.

Reference Books:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.
2. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
3. Soil Mechanics, T.W. Lambe & Whitman, Wiley Eastern Ltd, Nw Delhi.
4. Foundation Engineering, P.C. Verghese, Prentice Hall of India

BCE403-HYDRAULIC STRUCTURES (3-1-0) CR-04

Module - I (10 Hours)

Water requirement of crops, factors affecting water requirement, crop season, crop period, base period, delta and duty, consumptive use of water, frequency of irrigation, irrigation efficiency.

Module - II (10 Hours)

Systems of irrigation, lift irrigation, flow irrigation, methods of distribution of water, Flow irrigation: selection of dam or barrage site, types of canals, alignment of canals, design of canal section, Kennedy's and Lacey's theory, canal lining, canal head works.

Module - III (10 Hours)

Weirs and barrages: types of weirs and barrages and their components, Bligh's creep theory, Khosla's theory. Calculation of scour depth.

Dams: classification of dams, forces acting on gravity dams, economical height of gravity dams, stability analysis of gravity dams, earth dams, causes of failure of earth dams, methods of preventing failure of earthen dams, design of filters.

Module - IV (10 Hours)

Spillways: Type of Spillways and Energy dissipators, hydraulic jump, surges.

Cross drainage works.

Water logging: causes and effects of water logging, anti water logging measures.

Text Books

1. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Standard Publishers
2. Engineering Hydrology by K. Subramanya, Tata Mc Graw Hill
3. Irrigation Engineering by N.N. Basak, PHI

ELECTIVE-I (BCE404)

Advanced Mechanics of Materials (4-0-0) : Credits-04

Module-I

Theories of Failure: Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory, Comparison of failure theories for 2-D stress system. Mohr's theory of failure.

Module-II

Unsymmetrical bending: Properties of beam cross section, slope of neutral axis, stress and deflection in unsymmetrical bending, shear centre.

Curved Beams: Bending of beams with large initial curvature, Stress distribution in beam with rectangular, circular cross section, stresses in crane hooks, rings and chain links.

Module-III

Elementary concept of elasticity, stresses in 3D, equation of equilibrium and compatibility, plane stress and plane strain. Computer analysis of 2D state of stress and strain at a point.

Repeated stresses and fatigue in metals, Concept of stress concentration, notch and stress concentration factors.

Module-IV

Experimental stress analysis: Resistance strain gauges, strain rosettes, 2D photoelastic methods of stress analysis, stress optic law, light and dark field in a polariscope, isoclinic and isochromatic fringe patterns.

Reference Books:

1. Advanced Mechanics of Solids by L. S. Srinath
2. Advanced Mechanics of Materials by Kumar & Ghai

Theory of Plates and Shells (3-1-0): Credits-04

Plates: Pure bending of plates, Slope and curvature of slightly bent plates, relationship between moment and curvature, strain energy in bending of plates.

Differential equations for symmetrical bending of circular plates under lateral loads. Uniformly loaded, concentrically loaded and loaded at the center of simply supported and fixed circular plates. Differential equation of the deflection surface and boundary conditions of laterally loaded rectangular plates by classical theory. Solutions of simply supported rectangular plates due to sinusoidal loads, uniformly distributed loads and concentrated load by Navier's Solution, Levy approach.

Shells: Membrane theory of symmetrical loaded shells of revolution, Spherical shells, conical shells, Membrane theory of cylindrical shells and shells of Double curvature such as Hyperbolic paraboloids and elliptic paraboloids, conoids.

Circular cylindrical shells loaded symmetrically with respect to its axis, particular cases of symmetrical deformation of circular cylindrical shells, cylindrical tanks of uniform wall thickness.

Structural Design: Design of spherical dome.

Essential Reading

1. S P Timoshenko and S. W. Krieger ,Theory of Plates and Shells
2. O.P Billington, Thin Shell Concrete Structures

Supplementary Reading

1. [Eduard Ventsel & Theodor Krauthammer](#), Thin Plates & Shells: Theory, Analysis, & Applications CRC; 1st edition, 2001
2. Maan H. Jawad, Theory and design of plate and shell structures, Kluwer Academic Pub
3. Philip L. Gould, Analysis of shells and plates, Pearson Higher Education

Town Planning & Architecture (3-1-0) Credit: 04

Town Planning

Module – I

Elements of City plan, Surveys, Zoning, Housing, Slums, Parks & Play grounds, Public buildings & Town centres and Industries

Module – II

Communication & Traffic Control, Urban renewal & replanning the existing towns, Master plan, Planning law & Legislation.

Books for reference :

Fundamentals of town planning- G.K.Hiraskar- Dhanpat Rai Publication.

Architecture

Module – I

- i) Architecture as a fine art , its aim,importance and methods of study. Fundamental principles of architecture- Truth, beauty and Goodness.
- ii) Qualities and factors of beauty.
- iii) Qualities : Strength, Vitability, Restraint, Refinement, Repose, Grace, Breadth, Scale, Expression or setting out of purpose, Unity in concept, Factors : Mass, Form, Proportion, Balance, Symmetry, Solids, and voids, Light and shade.

Module – II

- i) Influence on architectural development : Effects of topography, Climate, Religion, Customs, Traditions, Technological development and aspirations of time.
- ii) Class in Orders : Definition, Doric, Ionic, Corinthian, Composite and Tuscan orders, Knowledge of the details of their parts and proportions.
- iii) Indian Architecture : Stupas, Chaityas and Viharas with examples. Jain style - Architectural character and example .
Hindu style – Dravidian temples and gopuram, Orissan group of temples with examples, Indo- Islamic architecture with examples.
- iv) Architectural character of modern architecture.

Reference Books :

1. Fundamentals of town planning -G.K. Hiraskar - Dhanpat Rai & Publication
2. architects & Builders hand book – Kiddar & Parker
3. The great ages of world architecture - G.K.Hiraska

WASTE MANAGEMENT AND POLLUTION CONTROL (3-1-0) CREDIT: 04

Module-I

Industrial Waste Water Treatment: Sources, Quantification and characterization of effluent, Waste water treatment process, Primary and secondary treatment of waste water, Aerobic and anaerobic treatment processes, various reactor configurations

Module-II

Industrial Air Quality Management: Sources, Quantification and characterization of emission, Control of particulate from flue gas, Particle dynamics, Particle size distribution, Dispersion and diffusion of pollutants in air, Gaussian dispersion equation, different types of dispersion models, Selection and design of air pollution control equipments: gravitational settling chamber, cyclone, bag filter, electrostatic precipitator, various type of scrubbers, Control of fugitive emission, Procedure for sampling of particulate matter in stacks

Module-III

Advanced Waste Water Treatment Processes: Fundamentals and mechanism of adsorption, adsorption isotherms, absorption, membrane separation and chemical oxidation processes and their design principles.

Module-IV

Waste Water and Air Quality Management in specific industries: Power plant, Fertilizer plant, Steel plant, Alumina refinery and smelters, Pulp and paper, Sugar and distillery, Dairies, Cement, Sponge iron industries

Reference books:

1. Wastewater treatment processes, Metcalf and Eddy, Tata McGraw hill
2. Environmental Engineering, Peavy and Rowe, Tata McGraw Hill

GROUNDWATER ENGINEERING (3-1-0): CREDIT-04

Module-I

Groundwater Occurrence: Groundwater hydrologic cycle, origin of groundwater, rock properties effecting groundwater, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

Groundwater Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing groundwater flow in three dimensions derivation, groundwater flow equation in polar coordinate system. Groundwater flow contours their applications.

Module – II

Analysis of Pumping Test Data – I: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well interface and well tests.

Analysis of Pumping Test Data – II: Unsteady flow towards a well – Non equilibrium equations – Thesis solution – Jacob and Chow's simplifications, Leak aquifers.

Module – III

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Groundwater: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Groundwater along with Case studies.

Module – IV

Saline Water Intrusion in Coastal aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunction use, Case studies.

TEXT BOOKS:

1. Groundwater Hydrology - David Keith Todd [John Wiley & Son, New York.]
2. Groundwater - H.M.Raghunath [Wiley Eastern Ltd.]

REFERENCES :

1. Groundwater Systems Planning & Management - R.Willes & W.W.G.Yeh [Prentice Hall of India.]
2. Applied Hydrogeology - C.W.Fetta [CBS Publishers & Distributors]

Machine Foundation (3-1-0): Credit-04

Module I

General Theory: Resonance and its effect; Theory of single-degree, two degree and multiple-degree of freedom system; Transient Response.

Module II

Evaluation of Design Parameters: Importance of design parameters; Geometric properties of machine foundations; Physical properties of the elastic base and their experimental evaluation

Module III

Analysis and Design of Block Type Machine Foundation: Mode of vibration of a block foundation; Methods for dynamic analysis; Foundation for machines inducing periodical and impact-type forces.

Module IV

Vibration Isolation: Active and passive type isolation; Methods of isolation in machine foundation; Isolation in existing machine foundation.

ELECTIVE-I (BCE405)

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

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

Module – I

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.

Module – II

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 noded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

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

Module – III

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

Module – IV

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

1. Logan, D. L., A First Course in the Finite Element Method, [PWS Publishing](#), Boston,
2. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc Hill.

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

Computer Aided Design by C. S. Krishnamoorthy

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

Module-I

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.

Module-II

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.

Module-III

Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of R.C Bridges,

Module-IV

Prestressed concrete bridges and steel bridges Fabrication, Lanching & 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

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

Module-III

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.

Module-II

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.

Module-III

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.

Module-IV

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

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

Module-I

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,

Module-II

Von Neumann method, CFL condition, some hydrodynamic techniques – Lax-Wendroff, MacCormack, Crank-Nicolson, staggered grid, ADI, ADE, pressure correction,

Module-III

SIMPLE and SOLA algorithm, method of characteristics, finite element method. Variational and weighted residual formulations,

Module-IV

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

SESSIONAL

BCE 491 -DESIGN OF STEEL STRUCTURES (0-0-3) CR-02

1. Design of Plate Girder
2. Design of Gantry Girder
3. Design of Roof Truss
4. Design of Water Tank

BCE 492 - DESIGN OF IRRIGATION STRUCTURES (0-0-3) CR-02

Design of a canal system with detailed design of its components e.g. impounding reservoir, Dam / Weir, most efficient and economical canal section, canal lining, canal sections upto the field channel as per the crop-water requirements in the given command area. (6x3=18 Hours)

Design of a water supply system as per the per capita demand of a given locality with detailed design of the components e.g. Treatment plant, Over Head Storage Reservoir, pipe lines, pumps, appurtenances, booster pumps, (4x3=12 Hours)

BCE 493 -MINOR PROJECT(0-0-3) CR-02

BCE 494 -SEMINAR(0-0-3) CR-02