COURSE STRUCTURE & SYLLABUS OF
BACHELOR OF TECHNOLOGY (B.TECH)

In

Civil Engineering

Course Structure

Third Year

Fifth Semester

Paper Code	Subject
BTC1	Design of RC Structures
BTC2	Foundation Engineering.
BTC3	River Engineering
BTC4	Hydropower Engineering
BTC5	Operation Research

BTC1 : DESIGN OF R.C. STRUCTURES

1. DESIGN PHILOSOPHIES
Introduction, Working Stress Method, Ultimate Load Method, Limit State Method, Limit State Method Vs Working Stress Method, Building Code, Accuracy Of Computations, Type Of Construction

2. SINGLY REINFORCED STRUCTURE
Introduction, Bending Of Beams, Cracked Concrete Stage, Ultimate Strength Stage, Assumptions, Moment Of Resistance, Modes Of Failure, Minimum And Maximum Tension Reinforcement, Effective Span

3. DOUBLY REINFORCED SECTIONS
Introduction, Types Of Problem, Stress In Compression Reinforcement, Design Steps, Minimum And Maximum Reinforcement, Design Tables, Flanged Beams, Effective Width Of Flange

4. SHEAR AND DEVELOPMENT LENGTH
Introduction, Shear Stress, Diagonal Tension, Shear Reinforcement,Spacing Of Shear Reinforcement, Development Length, Anchorage Bond, Flexural Bond

5. TORSION
Introduction, torsional stiffness of homogeneous sections, torsional stiffness of r. C. Sections, torsional reinforcement, distribution of torsion reinforcement, torsion in beams curved in plan

6. TYPES OF FLOOR
Introduction, One-Way Slab Systems, Two-Way Slab Systems, Flat Slab Systems, Flat Plate Systems, Grids.

7. COLUMNS AND WALLS

Introduction, effective height of a column, assumptions, minimum eccentricity, short column under axial compression, requirements for reinforcement, columns with helical reinforcement, short columns under axial load and uniaxial bending, construction of design charts, short columns under axial load and biaxial bending, slender columns, walls, construction of design charts, reinforcement in walls, corbels, truss analogy, detailing of reinforcement.

8. TYPES OF STAIRS
Introduction, common types of stairs, central-wall type stairs, central-column type stairs, slabless stairs, helicoidal stairs, free-standing stairs

9. RETAINING OF WALLS
Intorduction, forces on retaining walls, stability requirements, proportioning of cantilever walls, development length, loads on the heel, rear counterforts,

10. DESIGN OF TANKS
Roofs, ring beam, floors, walls of rectangular tanks, walls of circular tanks, shear force, steel ladder, base slab, cover to reinforcement , joints, design and detailing of joints, spacing of joints ,

11. MASONARY BUILDINGS
Introduction, Brick Wall Design Uner Vertical Loads

12. FOUNDATIONS
Introduction, minimum foundation depth., shallow foundations, use of plinth beams, brick wall design under horizontal loads, resistance to earthquake forces by wall boxed in plan, deep foundations

BTC 2 : FOUNDATION ENGG

1 INTRODUCTION
Soil as a three phase system, water content, density and unit weights, specific gravity, voids ratio, porosity and degree of saturation, density index

2 CLASSIFICATION OF SOILS
General, compaction, standard proctor test, equivalent for standard proctor test. [is *: 2720 a* (part vii) : 1965 : light compaction], water-density relationship, modified proctor test, modified proctor test curve, jodhpur mini-compactor test, typical comparison of the standard proctor test and jodhpur mini-compactor test, jodhpur mini-compactor, field compaction methods, field compaction control, proctor needle, calibration curve, factors affecting compaction, effect of compactive effort on compaction, obtained by the jodhpur mini-compactor, shear strength

3 STRESS DISTRIBUTION
Introduction, concentrated force: boussinesq equations, concentrated load: boussinesq, analysis, pressure distribution diagrams, variation of σ z with r at constant depth, vertical stress distribution on a horizontal plane (influence diagram for σz at a), σz distribution on vertical lane, vertical pressure under a uniformly, uniformly distributed load over circular area, vertical pressure due to a line load, vertical pressure under strip load, vertical. Pressure under centre of strip load, vertical pressure under a uniformly loaded rectangular area, rectangular loaded area, influence factor for rectangular area (after steinbrenner), equivalent point load method, newmark's influence chart, radii of concentric circles for influence chart, contact pressure,

4 SURFACE TENSION CAPILLARITY & EFFECTIVE STRESS
Modes of occurrence of water in soil, adsorbed water, adsorbed water and pore water (lambe, 1953), capillary water, surface tension and formation of meniscus, capillary rise, values of unit weight, dynamic viscosity and surface tension for water, capillary heights of soil, stress conditions in soil : effective and neutral pressures, capillary siphoning,

5 PERMEABILITY

Introduction, darcy's law, discharge velocity and seepage velocity, validity of darcy's law, factors affecting permeability, constant head permeability test, falling head , permeability test, permeability of stratified soil deposits,

6 SEEPAGE ANALYSIS

Head gradient and potential, seepage pressure, upward flow : quick condition
Sand condition, two dimensional flow: laplace equation, seepage through anisotropic soil, phreatic line of an earth dam , one dimensionalconsolidation, consolidation of laterally confined soil, semi log plot of pressure voids ratio relationship, consolidation of undisturbed specimen, terzaghi's theory of one dimensional consolidation, calculation of voids ratio and coefficient of volume change, calculation of voids ration by height of solids method, calculation of voids ratio by change in voids ratio method, determination of coefficient of consolidation, shear strength, theoretical considerations : mohr's stress circle, mohr-coulomb failure theory, the effective stress principle, measurement of shear strength, direct shear test, triaxial compression test, vane shear test , shear strength of cohesive soils

7 EARTH PRESSURE

Introduction , plastic equilibrium in soils : active and pasive states, active and passive states of plastic equilibrium, active earth pressure: rankine's throry, backfill with uniform surcharge, active earth pressure of cohesive soils, passive earth pressure : rankine's theory, coulomb's wedge theory

8 DESIGN OF GRAVITY RELATING WALL

Design of gravity relating wall

9 STABILITY OF SLOPES

Introduction, stability analysis of infinite slopes, stability analysis of finite slopes, the swedish slip circle method, stability of slopes of earth dam

10 SUBSOIL EXPLORATION

Introduction, site reconnaissance, site exploration, methods of site exploration, soil samples and samplers, disturbed sampling, undisturbed sampling, penetration and sounding tests, geophysical methods

11 SHALLOW FOUNDATION:

Types of foundations, spread footing, safe bearing pressure, settlement of footings, combined footing and strap footing, mat or raft footing, i.s. Code of practice for design of raft foundations, modulus of subgrade reaction K_s

12 WELL FOUNDATION

Introduction: caissons, shapes of wells and component parts, depth of well foundation and bearing capacity, forces acting on a well foundation, analysis of well foundation,
Heavy wells

BTC3 : RIVER ENGINEERING

1. RUN OFF

Introduction, Hydrograph, Runoff Characteristics Of Streams, Yield (Annual Runoff Volume), Flow-Duration Curve, Flow-Mass Curve, Sequent Peak Algorithm, Droughts, Surface Wter Resources Of India

2. STREAM FLOW MEASUREMENT

Introduction, Measurment Of Stage , Mesurement Of Velocity, Dilution Technique Of Streamflow Measurement, Electromagnetic Method, Ultrasonic Method, Stage-Discharge Relationship, Extrapolation Of Rating Curve, Hydrometry Stations

3. FLOODS

Introduction, Rational Method, Empirical Formulae, Unit Hydrograph Method, Flood-Frequency Studies, Gumbel's Method, Log-Pearson Type Iii Distribution, Partial Duration Series, Regional Flood Frequency Analysis, Limiations Of Frequency Studies, Design Flood, Design Storm, Risk, Reliability And Safty Factor

4. FLOOD ROUTING

Introduction, Basic Equations, Hydrologic Storage Routing, Attenation, Hydrologic Channel Routing, Hydraulic Method Of Flood Routing, Routing In Conceptual Hydrograph Devlopment , Clark's Method For Iuh, Nash's Conceptual Model, Flood Control, Flood Forecasting, Flood Control In India

BTC 4 : HYDROPOWER ENGINEERING

1. WATER POWER DEVELOPMENT
Definition, the hydrologic cycle, hydrograph, flow duration curve, mass curve, hydropower plant, hydroplant controls, combined hydro and steam power plants .

2. HYDRAULIC MACHINES
Introduction, turbines, general layout of a hydro-electric powerplant, definitions of heads and efficiencies of turbines, classification of hydraulic turbines, pelton wheel (or turbine), radial flow reaction turbines, velocity triangles and work done by water on runner, outward radial flow reaction turbine, Francis turbine, design of Francis turbine runner, design of Francis turbine runner, deriaz turbine, scale effect
Performance characteristics of hydraulic turbines, constant efficiency or iso-efficiency or muschel curves, Governing of reaction turbines, cavitations, selection of hydraulic turbines, surge tanks.

3. CENTRIFUGAL PUMPS
Introduction, classification of pumps, water hammer in pipes

BTC 5 : OPERATIONS RESEARCH

1. **CLASSIFICATION OF O.R. MODELS**
   Physical Models, Symbolic Models, Advantages Of A Model, Limitations Of The Model, Scope Of Operations Research In Management

2. **LINEAR PROGRAMMING FORMULATION & GRAPHICAL METHOD**
   Introduction, Basic Requirements, Basic Assumptions, Advantages Of Linear Programming, Limitations Of Linear Programming, Application Areas Of Linear Programming, Formulation Of Linear Programming Models
3. **TRANSPORTATION**
   Example, Agriculture, General Mathematical Formulation Of Linear Programming Problem, Definitions
4. **SOME SPECIAL CASES**
   Multiple Optimal Solutions, Infeasible Solution, Contradictory Constraints, Unbounded Solution
5. **LINEAR PROGRAMMING**
   The Simplex Method, Introduction, Standard Form Of Linear Programming Problem, Slack And Surplus Variables, Slack Variable
6. **STEPS OF THE SIMPLEX METHOD**
   Steps of the Simplex Method (Maximization Case), Flow Chart of the Simplex Method, Simplex Method (Minimization Case), Steps of the Simplex Method (Minimization Case), Maximization Case (Constraints of Mixed Type), Resolution of Degeneracy

7. LINEAR PROGRAMMING, DUALITY

Introduction, Formulation Of Dual Problem, Interpreting Primal-Dual Optimal Solutions, Solving The Primal-Dual Problem**,** Dual Of A Primal With Mixed Constraints, Important Primal-Dual Results, Advantages Of Duality, The Dual Simplex Method

8. TRANSPORTATION PROBLEM

Methods For Finding Initial Solution, North-West Corner Method (NWCM), Least Cost Method (LCM), Vogel's Approximation Method (VAM), Stepping-Stone Method, The Dual of Transportation Problem, Alternative Optimal Solutions, Unbalanced Transportation Problems, Supply Exceeds Demand, Demand Exceeds Supply, Degeneracy in the Transportation Problem, Prohibited Routes, Profit Maximization in a Transportation Problem, Trans-shipment Problem, Time-Cost Trade-of in the Transportation problem

9. HUNGARIAN METHOD OF ASSIGNMENT PROBLEM

Minimization Case, Variations Of The Assignment Problem, An Application--Airline Crew Assignment, Travelling Salesman Problem

10. NETWORK MODELS : PERT & CPM

Objectives of network analysis, Application of network models, Advantages of network models, Project network, Difference between PERT and CPM, Activities, Events, Estimating Activity Times, Effect of Introducing a Dummy Activity in a Network, Probability Statements or Project Duration, Probability of completing the project on or before a specified time, PERT algorithm

11. FLOAT OF AN ACTIVITY

Introduction, Optimization of Project Time and Cost in a PERT Network, Limitations of PERT/CPM

12. QUEUING MODELS

Basic Components of the Queuing System, Input Source, Queue Discipline, Service Mechanism, Classification of Queuing Systems, Characteristics of Model I**,** II, III

13. INVENTORY CONTROL MODELS

Principal Categories of Inventories and Their Functions, Structure of Inventory Management System, The Basic Deterministic Inventory models, Multiple Item Deterministic Models, Limitation set up by capital restriction, Aggregate resource limitations, Selective Inventory Control, Application of ABC analysis, Inventory Control Systems, Reorder level, Probabilistic Models

14. SYSTEM TERMINOLOGY

System and Simulation models, Random Variable and Random Numbers, Monte-Carlo Simulation, Generation of Random Numbers, Simulation and Inventory Control, Simulation and Queuing System, Simulation and Capital Budgeting , Limitations of Simulation, Simulation Languages, Simulation Applications

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