Detailed Contents of Courses for the M.Engg Programme in Civil Engineering

Geo-technical Engineering

CE-531 Advanced Soil Mechanics

Physical characteristic of soils and their identification, clay mineralogy, clay-water relations. Numerical, mathematical and sketching solutions for simple steady-state flow problems. Stress in soil mass under applied stresses for two and three dimensional problems, equilibrium equations, stress invariants and octahedral stresses. One dimensional consolidation equation and its mathematical analysis, immediate and consolidation settlement analysis for thin and thick soil layers, plasticity or creep effetcs (Deconday consolidation). Shearing strength of cohesionless and cohesive soils using Mohr-columb failure criteria. Critical state theory; representation of stress path on the Rendulic Plot, critical state live and equation, Roscor and Hvorseleve surfaces and their equations.

CE-532 Foundation Engineering

Properties of sub-surface materials for classification, Bore logs information for foundation selection. Selection criteria of foundation resting on various types of soils, foundation on non- uniform soils and rocks. Case studies of actual foundation problems. Development of theoretical bearing capacity equations for shallow and deep foundations under drained and undrained conditions. Design procedures and behaviour of different types of foundation. Introduction to seismic behaviour of subsoil and building foundations. Foundation problems solution by Finite Difference method, Reinforced earth, Beam on elastic foundation and Lateral thrust due to compaction of soil by rollers.

CE-533 Soil-Foundation Dynamics

Vibration of elementary systems, foundation vibratory theory, foundation design for vibratory loads, foundation isolation, wave propagation theory, response of soils to dynamic loading, dynamic soil properties, field and laboratory methods for evaluation of dynamic soil properties, liquefaction of sands, vibratory compaction of granular materials.

CE-534 Soil Investigation & Testing

Purpose, planning of Subsurface exploration, Sub-soil investigation by conventional and geophysical methods. Sampling techniques: Standard static and dynamic laboratory tests for measurement of Soil Properties, In-situ groundwater conditions. Lab work related to the tests covered, report preparation.

CE-535 Earth Structures

Failure Mechanisms in Natural and Artificial Slopes. Stability Analysis for slopes in Cohesive, Non-Cohesive and C-phi soils. Use of stability charts. Steady state seepage problems in Earth Structures. Influence of surcharge, submergence and tension crack on Stability. Numerical Integration Analysis by Fellenius Method and Bishop's Simplified Method. Principles of Design and Stability Analysis of Earth and Rock Fill Dams under Drained and Un-drained conditions: stress Distribution and Deformation within the Dam and Foundation Strata. Effect of earthquakes on slope stability.

CE-536 Soil Stabilization

Principles and methods of altering engineering properties of soils. Mechanisms of soil stabilization. Mechanical, electrical and thermal stabilization. Specifications, construction and control methods. Types of compaction equipment. Optimum utilization of compaction equipments. Use of geo-textile fabrics for stability of soft & compressible soils.

CE-537 Rock Mechanics

Rock as Material, Rock Formation and Structure, Folding, Faulting and Joints. Analysis of Stress and Infinitesimal strain. Friction, Linear Elasticity. Strength of Rock and Cemented granular materials. Crack Phenomena and the Mechanism of Fracture. Fluid Pressure and Flow in Rocks. Brittle and Creep Behaviour, Determination of Static and Dynamic Mechanical properties of Rock in laboratory and field, Mining and other Civil Engineering Applications. Rock Slope Engineering.

CE-538 Groundwater & Seepage

Hydromechanics of confined and unconfined flow of water through soils, potential theory, conformal mapping transient flow. Applications to design of earth dams.

CE-539 Subsurface Hydrology

Introduction: Groundwater and hydrologic cycle, Groundwater as a Resource, Groundwater as geotechnical problem. Physical Properties and Principles: Basic principles of fluid flow in saturated and unsaturated materials Hydraulic Head and Fluid Potential, Darcy’s Law, Hydraulic Conductivity and Permeability, Transmissivity and storativity, Aquifers and Aquitards, Steady State and Transient Flow Equations of Groundwater Flow; Infiltration and TGroundwater Recharge. Groundwater Resource Evaluation: Development of Groundwater Resources, Exploration, Evaluation and exploitation, Well, Aquifer and Basin Yields, Exploration for Aquifers; Geological and Geophysical Methods, Drilling, Installation of Wells and Piezometers, Pumping Tests, Groundwater Quality, Well head Protection. Groundwater monitoring, Groundwater models—analytical and numerical models. Groundwater and Geotechnical Problems/Applications: Artificial Recharge, Seawater Intrusion,Drainage and Dewatering, Pore Pressure, Land Subsidence, Landslides and Slope Stability.

CE-540 Earth Retaining Structures

Pressure on Retaining Walls. Basic Concepts and Earth Pressure Theories. Design criteria and Pressure Analysis of Rigid Walls with and without surcharge Loads. Effect of seepage and Drainage on Walls. Pile-supported Retaining Wall. Behaviour of Flexible Earth-Retaining structures. Design Criteria and Pressure Analysis of Anchored Bulk Heads, Braced Out and Tie-Back Bracing system, Design criteria for cellular cofferdams. Behaviour of Retaining Walls during earthquakes.

CE-541 Computer Applications in Geo-technical Engineering

Numerical solutions of partial differential equations, Finite difference Approximation solutions to two-dimensional flow field and one-dimensional consolidation Soil Layer. Finite Element Method application to stress analysis of Linearly elastic systems of Geotechnical Engineering problems. Soil-foundation Dynamics Interaction problems.

CE-542 Geoenvironmental Engineering

Introduction: Emergence of Geoenvironmental Engineering, Types of Geoenvironmental Problems.Chemical Background And Geochemistry: Toxic Chemicals, Inorganic Chemistry, Organic Chemistry, Nuclear Chemistry,Chemical Analysis Methods. Contaminant Transport Mechanism: Introduction, Sources of Contamination, Types of Contaminants, Transport Processes, Chemical Mass Transfer Processes , Biological Process (Biodegradation), Contaminant Transport and Fate Modeling, Applications. Contaminated Site Characterization And Risk Assessment: Preliminary Site Assessment, Exploratory Site Investigation, Detailed Site Investigation, Risk Assessment Procedures, Remedial Strategy. Waste Management And Landfill Design: Sources of Wastes, Classification of Wastes, Waste Characterization, Environmental Concerns with Wastes, Waste Management Strategies, Landfill Configurations, Waste containment liner systems, Containment System Liner Design, Leachate collection and removal system, Final cover systems, Gas generation and management, End uses of closed landfills.