Syllabus for M. Tech. (Sponsored) admission at NIT Srinagar

Session: 2020-21

(GEOTECNICAL ENGINEERING)

1. CORE COURSES

Soil Mechanics

Soil and its formation, processes and agencies involved in formation types of soils, three phase soil model, index properties and classification of soils. Flow through soils, Laplace equation for steady flow. Effective stress concept and pore pressure, Compaction of soils and its field application; stress distribution under loaded plates; Clay Mineralogy, Basic structural units, Isomorphic substitution, base exchange capacity, inter automatic and inter molecular bonds, different clay minerals; Engineering properties of clay minerals, permeability, swelling & shrinkage and stress – strain characteristics of soil and consolidation theory; review of conventional shear stress factors affecting shear strength of soils – pore pressure in soils – pore pressure measurements in triaxial test and field measurements – total and effective shear stress parameters, stress path, total stress path and effective stress path – Horslave shear parameters – shear strength , thixotropy and liquefaction of soils.; Compressibility of Soils**:** Concept of Stress, Principal Stress and Strain, Stress – Strain relations, plane Stress, Plane Strain, Mohr's diagram.; Settlement and consolidations: ultimate Settlements (Consolidation Test), Time rate of Consolidation, Effect of Layers and changes in parameters on the rate of consolidations.

Shallow Foundations

Soil Investigations: Methods of soil exploration, Factors affecting site investigation, Planning sub soil exploration programme, Spacing and depth of borings, Location of borrow areas, bore log, Types of Shallow Foundations: Strip pad, Combined**.**

Bearing Capacity: Terzaghi's factors, Accuracy of Terzaghi's factors, Effect of footing shape, Net bearing capacity, General formulae, Soil layers of finite depths, Non uniform soils, Strength increasing with depth, Footings on slopes, Layered soils; Settlement: Limits of settlement, Settlement computation, theory of elasticity, 1-D Conditions, 3-D problems, Rate of settlement, Settlement of footings on sand, determination of BC based on settlement and bearing criteria.

Raft Foundations: Raft types, Net zero pressure, Bearing capacity on sand and clays, Settlement calculations.

Foundation – Soil Structure Interaction: Idealized soil behavior – Foundation behavior, Interface behavior, Analytical techniques, Scope of soil – Foundation interaction Analysis. Beams on Elastic Foundations: Winkler and Modified Winkler Models, Theory of sub grade reaction, Applications of solution of beams on elastic foundations for footings and rafts, Finite Difference Method.

Pile Foundations

Types of Piles, Criteria for Design, Pile Load Capacity, Group Effects, Design charts and equations for single pile, pile group settlement, pile load testing, Negative Skin friction, Settlements and deformation prediction, Well Foundations: Shapes, component parts, Depth of well foundation and bearing capacity, Forces acting on a well foundation, Analysis of well foundation, well curb, cutting edge, staining and bottom plug, well sinking.

Earth Pressure and Retaining Structures

Earth Pressure Theories and Retaining Walls: conventional retaining wall, Gravity and Cantilever walls, shut pile walls Cantilever & Anchored)..; Strutted excavations: Stability of slopes to open excavations, Support of excavations, Structural Design of Supports to excavation, Over all stability, inward yielding and settlement of ground surrounding excavation.; Reinforced Earth Walls: Concepts – Designs

Stability of Earth Slopes

Slope aspect ratio, Classification of slopes - Infinite slopes, Finite slopes, Slope failure, Mechanism of slope failures, Stability analysis of finite & infinite slopes, Total & Effective Stress approach, Stability number, Swedish and Friction circle methods. Submergence case, complete draw down case, Steady seepage case.

Soil Stabilization

Objectives of soil stabilization, Difference between soil improvement and soil stabilization, Methods of stabilization- Mechanical, Chemical & Inclusions such as granular piles, application of geosynthetics, field improvement techniques.

Soil Dynamics

Fundamentals of Soil Dynamics**,** Determination of dynamic soil parameters, Machine foundations, Design approach for machine foundation of successive elimination.; Iterative method – gauss Siedel method, Relaxation methods.

Introduction to Finite Element Analysis

Various steps in solving a problem by finite Element Method (displacement approach). Two dimensional method elements.; Formulation of the finite element method using (i) Principle of virtual work (ii) Minimization of total potential energy of a system, Discrete Element Method.

2. Allied Areas

Surveying

Principles of surveying, types of surveying; Leveling and trignometrical leveling; Theodolite surveying; Tacheometry, Geodetic surveying, areas and volume, curves.

Structural Engineering

Analysis of stress and strain, flexural and torsional load analysis, determinate and indeterminate structures, bending and shear stresses, compound stresses, slopes and deflections, columns.

Highway Engineering

Classification of roads, Comparison with other modes of transportation, Highway alignment and geometrics, Factors affecting Pavement Design, Traffic Characteristics, Properties and tests for road aggregates and bituminous materials, Design of Bituminous concrete mix, Hill roads, Various types of Bridges, Waterway calculations, Design criteria for Bridge Foundations.

Fluid mechanics and Hydraulics

Basic fluid flow concepts, fluid statics, fluid kinematics and dynamics, pressurized flow, water hammer, laminar and turbulent flow; open channel hydraulics, irrigation engineering; water quality and waste treatment.

Mathematics

Differences, Differences Formulae, Difference table, Operator E, Properties of the operator E and Δ, Leibnitz rule – Interpolation with equal intervals, unequal intervals, Central difference interpretation formulae.; Numerical Differentiation and Integration and Inverse Interpolation; Numerical solution of ordinary difference equations of the first and second order; Simultaneous linear algebraic equations – methods of solution using the inverse of the matrix, method of successive elimination.; Iterative method – gauss Siedel method, Relaxation methods.

General Awareness & Current Affairs - Will Consist Of:

a. Major Events & Current Affairs - National/International

b. Personalities in News

c. Sports News

d. News about Power Sector in India

General Aptitude Will Consist Of:

a. Numerical aptitude

b. Ability to read graphs & tables

c. Data interpretation