CIPC2006 GEOTECHNICAL ENGINEERING (3-0-0)

Course Objectives:

The course in Geotechnical Engineering aims to provide students with a comprehensive understanding of soil mechanics and its engineering applications. It seeks to develop advanced knowledge of soil formation, classification, and behavior under various stress conditions. Students will explore critical concepts including soil properties, permeability, seepage, compaction, consolidation, and shear strength. The objective is to equip students with theoretical and practical skills in analyzing soil systems, understanding complex geotechnical phenomena, and applying sophisticated techniques for soil characterization, testing, and stabilization in civil engineering and construction contexts.

Module-I

Introduction: Origin of soils, formation of soils, clay mineralogy and soil structure, basic terminology and their relations, index properties of soils. Soil classification: Particle size distribution, use of particle size distribution curve, Particle size classification, textural classification, HRB classification, Unified classification system, Indian standard soil classification system, Field identification of soils. Capillary tension, capillary siphoning. Stress conditions in soil: Total stress, pore pressure and effective stress

Module-II

Permeability: Darcy‘s law, permeability, factors affecting permeability, determination of permeability(laboratory and field methods), permeability of stratified soil deposits. Estimation of yield from wells.

Seepage analysis: Seepage pressure, quick condition, Laplace equation for two –dimensional flow, flow net, properties and methods of construction of flow net, application of flow net, seepage through anisotropic soil and non-homogenous soil, seepage through earth dam. Inverted filter and design of inverted filter.

Module-III

Soil compaction: Compaction mechanism, factors affecting compaction, effect of compaction on soil properties, density moisture content relationship in compaction test, standard and modified proctor compaction tests, field compaction methods, relative compaction, compaction control.

Soil consolidation: Introduction, spring analogy, one dimensional consolidation, Terzaghi‘s theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation

Module-IV

Shear strength of soils: Mohr‘s stress circle, theory of failure for soils, determination of shear strength(direct shear test, tri-axial compression test, unconfined compression test, van shear test), shear characteristics of cohesion less soils and cohesive soils.

Module-V

Stabilization of soil: Introduction, mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, thermal stabilization, electrical stabilization, Introduction to modern methods of stabilization

Course Outcomes:

1. To Classify soil and solve three phase soil system
2. To Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
3. To Formulate practical problems related to consolidation settlement and time rate of settlement.
4. To Validate problem related to compaction in the field.
5. To Use stabilization techniques for soft and expansive soil by using various methods

Text and Reference Books:

1. S. K. Gulhati and M. Datta, Geotechnical Engineering, McGraw Hill Company
2. V. N. S. Murthy, Principles of Soil Mechanics and Foundation Engg, UBSPD.
3. I. H. Khan, A text book of Geo-technical Engg, Prentice Hall India.
4. B. C. Punmia, A text Book of Geo-technical Engg, Laxmi Publications.
5. G. Ranjan& A. S. R. Rao, Basic and Applied Soil Mechanics, Wiley Eastern Ltd.
6. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher
7. Venkatramaiah, Geotechnical Engineering, New Age International publishers.