> **Objectives:**
> - To enable the student to assess the physical and engineering behaviour of soils
> - To familiarise students with fundamental concepts of water flow through soil, stress transformation and distribution, shear strength, consolidation, and slope stability analyses.

Unit I: INTRODUCTION – SOIL DEPOSITS AND CLASSIFICATION

Introduction; factors influencing the nature and formation of soils; phase relationships; soil deposits and their engineering properties; soil classification for engineering purposes – BIS classification system, Unified Soil Classification System (USCS); clay – types of bonds in clay, genesis of clay minerals, important clay minerals, base exchange capacity, attractive and repulsive forces in clays, diffused double layer theory; index properties of soils

Unit II: SOIL WATER AND WATER FLOW

Soil water; surface tension; capillary tension; soil suction; permeability – hydraulic head, Darcy's law, coefficient of permeability, factors influencing permeability of soils; seepage – Laplace's Equation, flow nets, Effective stress principle; quick sand condition; effective stress in partially saturated soils

Unit III: ELASTIC THEORIES OF STRESS DISTRIBUTION

Stresses under different loads; Newmark's influence charts; elastic theories of stress distributions in soils – Boussinesq's Equation, Westergaard's Solution, Burmister method, limitations of elastic theories

Unit IV: COMPACTION AND CONSOLIDATION

Compaction: Soil compaction, factors affecting compaction, effect of compaction on soil properties, compaction tests
Consolidation – initial, primary, and secondary consolidation, Terzaghi's theory of consolidation, solution of basic differential equation, causes of pre-consolidation in soils, estimation of pre-consolidation pressure, three dimensional consolidation, pre-compression of clay deposits with and without sand drains

Unit V: SHEAR STRENGTH

Introduction; Mohr's Circle; shear strength parameters of cohesionless and saturated cohesive soils; effect of rate of stress on shear parameters; different types of shear tests and drainage conditions; relationship between undrained shear strength and effective overburden pressure; stress path; effect of over-consolidation on shear parameters

Unit VI: INTRODUCTION TO SLOPE STABILITY

Stability analysis of slopes; various factors of safety; types of slope failures; stability of infinite slopes of cohesive and cohesionless soils; Bishop's Simplified Method; Fellenius Method; Bishop-Morgenstern stability coefficients

Laboratory

Grain size analysis – sieve tests and hydrometer analysis; index properties, one dimensional consolidation; permeability; shear tests

TEXT BOOKS/ REFERENCES:

1. Arora K.R., *Soil Mechanics and Foundation Engineering*, Standard Publishers Distributors, 2002
2. Das B.M., *Advanced Soil Mechanics*, CRC Press, 2013
3. Budhu M, *Soil Mechanics and Foundations*, John Wiley & Sons, Inc., 2010