

CIPE3001 ADVANCED GEOTECHNICAL ENGINEERING (3-0-0)

Course Objectives

- To equip students with fundamental and advanced knowledge in foundation engineering, enabling them to analyze and solve real-world geotechnical problems such as stress distribution in soils and consolidation behavior of soil.
- To develop the ability to apply engineering principles in the design of geotechnical systems, including shallow foundation, pile foundation, retaining structures, etc., while considering practical factors influencing soil behavior and load-bearing capacities.
- To enable students to assess and evaluate slope stability under various field conditions by applying appropriate analytical techniques, and to determine the factor of safety, ensuring the safe design of slopes in geotechnical engineering projects.

Module-I: (08 Hrs)

Stress distribution in soil: Boussinesq equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, strip load, uniformly loaded circular and rectangular areas. Use of Newmark's chart. Westergaard's solution. Approximate methods (point load method, two-to-one load distribution method). Contact pressure distribution due to loaded areas. Concept of active zone.

Module-II (08 Hrs)

Shallow foundation: Introduction, bearing capacity, methods and determination of bearing capacity, settlement of foundations. Deep foundation: Classification of pile, pile driving methods, pile capacity (static and dynamic analysis) pile-group analysis, load test on piles.

Module-III (08 Hrs)

Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings), indirect (sounding, penetration tests, and geophysical methods). Planning of exploration programme, spacing and depth of boring, soil sampling, types of samples, standard penetration test, static and dynamic cone penetration test, in-situ vane shear test. Seismic refraction method, electrical resistivity methods.

Module-IV (08 Hrs)

Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, Rebhann's and Culmann's graphical methods, stability conditions for retaining walls.

Course Outcomes:

After successfully studying this course, students will able to:

- Understand the basic concept of foundation engineering and determine the vertical stresses using various stress distribution theories to solve practical soil stress problems in geotechnical engineering subjected to various types of loading.
- Apply the concept of consolidation to carry out settlement analysis of real-world settlement problems in soils.
- Identify different types of shear failures, analyze the factors influencing bearing capacity, and determine the bearing capacity for various shallow foundation shapes like square, rectangular, and circular
- Analyze the factors influencing bearing capacity and calculate the load-carrying capacity of single pile and pile group.

Books:

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