

SHIV NADAR UNIVERSITY

- I. **Course Title:** Foundation Engineering
- II. **Course Code:** CED 306
- III. **Course Credits (L:T:P):** (3:0:0)
- IV. **Course Type:** Major
- V. **Prerequisite/s (If Any):** CED 302
- VI. **Course Coordinators/Instructor(s):** Dr. Gyan Vikash
- VII. **School:** School of Engineering
- VIII. **Department:** Civil Engineering
- IX. **Objective:** The objective of this course is to introduce fundamental concepts and application of foundation analysis and design to civil engineering students. This course is designed to provide adequate knowledge to design foundations of structures such as buildings, bridges, retaining structures, dams, etc.,
- X. **Learning Outcomes:** Upon successful completion of the course, student should be able to
 - Analyze soil data and select suitable design parameters
 - Plan subsurface exploration program
 - Analyze and design the foundations
 - Understand influence of various factors on foundation design
 - Analyze and design retaining walls
 - Understand various construction problems
 - Find a practical solutions of the construction problems
- XI. **Course Content:**

Module 1: Revision of Soil Mechanics Principles: Nature of soil, three phase system, index properties of soil, soil classification, groundwater, engineering properties of soil, permeability, the principle of effective stress, pore-pressure in soil due to applied load, shear strength of soils, consolidation

Module 2: Site Investigation: Purpose of subsurface exploration, subsurface exploration program, exploratory boring in the field, procedures for sampling soil, observation of water tables, field tests, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), Static Cone Penetration Test (SCPT), Vane Shear Test, Plate Bearing Test, Pressure meter Test, Soil Data and Design Parameters

Module 3: Stress Distribution in Soils: In-situ Stress, Stresses due to foundation loading, Vertical stresses below uniform rectangular load, Vertical stresses below circular load,

Other common loading types: uniform line load, uniform strip load, triangular load, embankment type loading, Stress at any point below rectangular loading, Newmark's Chart, Pressure bulb, Rigidity of Footings: Contact pressure, Approximate method of determining vertical stress

Module 4: Foundations- Types and Design Criteria: Types of Foundation: Shallow foundations, Deep foundations, Choice of foundation type, Design criteria: Bearing capacity, Settlement criteria, Bearing capacity of shallow foundations, Failure mechanism: Prandtl's analysis, Terzaghi's analysis, Skempton method, Meyerhof's method, Hansen's method, Vesic's method, Bearing capacity of non-homogeneous soil, Factors affecting bearing capacity, Gross and net soil pressure, Safe bearing capacity

Module 5: Settlement Analysis: Methods of settlement analysis, Stresses during loading and consolidation in the field, Influence of stress path on the drained deformation of clay, Settlement analysis by stress-path method, Rate of settlement, Settlement of foundation rested on sand – Elastic theory, Semi-empirical method, Plate load test, Static cone test

Module 6: Lateral Earth Pressure and Retaining Walls: Lateral earth pressure at rest, Rankine active earth pressure, Rankine passive earth pressure, Rankine active earth pressure for inclined backfill, Rankine passive earth pressure for inclined backfill, Coulomb's active earth pressure, Coulomb's passive earth pressure, Gravity and Cantilever Walls – Proportioning retaining walls, Application of lateral earth pressure theories to design, Stability of retaining walls, Check for overturning, check for sliding along the base, check for bearing capacity failure, Construction joint and drainage from backfill

Module 7: Pile Foundations – Types of piles and their structural characteristics, Estimating pile length, Installation of piles, Load transfer mechanism, Equations for estimating pile capacity, Frictional resistance in sand, Frictional resistance in clay, Point bearing capacity of piles resting on rock, Pile load tests, Elastic settlement of piles, Laterally loaded piles, Pile-driving formulas, Negative skin friction, Group piles, Ultimate capacity of group piles in saturated clay, consolidation settlement of group piles

Module 8: Construction Problems – Common construction problems, Stability of excavation, Dewatering, Land filling, Effect on adjoining structures

XII. Recommended Books:

- [1] N.N. Som and S. C. Das (2009), Theory and Practice of Foundation Design, Prentice Hall
- [2] B. M. Das, Principles of Foundation Engineering, Thomson Books
- [3] V.N. S. Murthy, Advanced Foundation Engineering, CBS Publishers

XII. Assessment Scheme:

- [1] Project 1: 10 %
- [2] Project 2: 10%
- [3] Quiz: 20 %
- [4] Term Paper: 10%
- [5] Mid Semester Exam: 20 %
- [6] Final Exam: 30 %