FOUNDATION ENGINEERING

ENCE 302

Lecture : 3 **Year : III**
Tutorial : 2 **Part : I**
Practical : 1

Course Objectives:
The objective of this course is to provide a comprehensive understanding of the geotechnical investigation and analysis of structures commonly encountered in civil engineering practice. It focuses on the stability analysis of slopes, analysis of flexible and rigid retaining structures, and analysis of shallow and deep foundations under various ground conditions.

1 Geotechnical Investigation (8 hours)

1.1 Geotechnical investigation; Objective and scope
1.2 Stages and extent of site exploration
1.3 Methods of site exploration: Accessible, inaccessible and indirect methods
1.4 Soil sampling (Disturbed and undisturbed) and samplers
1.5 Field tests (Standard penetration test, static cone penetration test, dynamic cone penetration test, pressure meter tests and dilatometer test)
1.6 Ground water observation and borehole logs
1.7 Geophysical tests and their application
1.8 Evaluation of liquefaction potential

2 Slope Stability Analysis (4 hours)

2.1 Types of slopes and possible failures
2.2 Analysis of infinite slopes
2.3 Analysis of finite slopes ($Ø_u$=0, friction circle, method of slices)
2.4 Use of stability charts

3 Earth Pressure Theories (5 hours)

3.1 Earth pressure and slope retaining structures
3.2 Wall movement and types of earth pressure
3.3 Rankine earth pressure theory
3.4 Coulomb earth pressure theory
3.5 Culmann's graphical solution

4 Bearing Capacity Theories (4 hours)

4.1 Basic terminologies and their relationships
4.2 Types of shear failure

4.3 History and development of bearing capacity theories
4.4 Terzaghi's bearing capacity theory
4.5 Corrections on Terzaghi's bearing capacity equation
4.6 Skempton, Meyorhof, Brinch Hansen and Vesic's methods

5 Analysis of Shallow Foundation (7 hours)

5.1 Shallow foundation and its types
5.2 Settlement of foundation, its types and effects
5.3 Allowable bearing capacity of strip and isolated footings
5.3.1 Bearing capacity from in-situ tests and laboratory test results
5.3.2 Safe bearing pressure
5.4 Raft foundation and its types
5.5 Bearing capacity of raft foundation
5.6 Stress distribution and settlement of raft foundation
5.7 Foundation on stratified soil

6 Analysis of Deep Foundation (6 hours)

6.1 Deep foundations: Pile, pier and caisson and their classification
6.2 Load carrying capacity of single pile (Static, in-situ tests, dynamic and pile load test) and group action of pile
6.3 Settlement of pile foundation
6.4 Lateral and uplift capacity of pile
6.5 Construction and quality assurance of pile foundation
6.6 Negative skin friction
6.7 Analysis of pier foundation
6.8 Components of well (Caisson) foundation
6.9 Lateral stability of well foundation
6.10 Sinking of well, problems and remedial measures

7 Analysis of Foundation in Rock (3 hours)

7.1 Basis for design of foundation on rock
7.2 Foundations on weathered and un-weathered rock
7.3 Bearing capacity and settlement of foundation
7.4 Treatment of rock defects

8 Retaining Structures: Rigid and Flexible (8 hours)

8.1 Types of rigid and flexible retaining structures and their application
8.2 Proportioning and stability analysis of rigid retaining wall
8.3 Theory of arching
8.4 Flexible retaining structures (Type and function)
8.5 Analysis of sheet piles

8.6 Analysis of braced excavation
8.7 Analysis of reinforced or mechanically stabilized earth wall

Tutorial **(30 hours)**

1. Sampler requirement, correction of standard penetration values, correlations of penetration results, liquefaction potential evaluation
2. Analysis of finite and infinite slopes
3. Calculation of earth pressures using Rankine and Coulomb's theories
4. Bearing Capacity analysis of shallow foundation
5. Bearing capacity analysis of deep foundation
6. Bearing capacity analysis of foundation in rock
7. Analysis and design of flexible retaining structures

Practical **(15 hours)**

1. Video presentation of drilling methods
2. Drilling by any one method
3. Standard penetration test
4. Sample collection and laboratory tests

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Mark distribution*
1	8	8
2	4	6
3	5	8
4	4	6
5	7	8
6	6	10
7	3	4
8	8	10
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Das, B. M. (2020). Principles of Geotechnical Engineering. Cengage Learning.
2. Arora, K. R. (2019). Soil Mechanics and Foundation Engineering (Geotechnical Engineering). India: Standard Publishers.
3. Murthy, V. (2003). Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. Switzerland: Taylor & Francis.
4. Bowles, J. E. (1978). Engineering properties of soils and their measurement (Latest Edition). United Kingdom: McGraw-Hill.