Course Code	Course Title	L	T	P	C
17CE014	ADVANCED FOUNDATION ENGINEERING	3	0	0	3

Course Objectives:

The primary objective of this course is

1. To equip the student with the knowledge of how to explore the soil
2. To estimate the bearing capacity of soil, design the foundations for different conditions and check the stability of structures.
3. To understand the basics of dynamics – dynamic behavior of soils – effects of dynamic loads and the various design methods

Course Outcomes:

At the end of the course student will be able to

1. Determine the earth pressures on foundations and retaining structures.
2. Analyse shallow and deep foundations.
3. Calculate the bearing capacity of soils and foundation settlements.
4. Able to design foundation for different machines.
5. Able to assess the influence of vibrations.

Activities:

1. Analyze active and passive earth pressures acting on to a retaining wall with the properties of the soil given, using any theory, using some soft wares
2. Determining the actual active pressure and the actual failure plane for a retaining wall backfill using Culmann's Graphical Method
3. Suggest a suitable foundation for the given soil and load conditions and justify it.
4. Make a working model of spring and dashpot system to understand behavior of foundation under vibrations
5. Take example for machine foundation and find out various modes of failures using Linear Elastic weightless spring method, Elastic half space method and Analogue models.

Skills:

1. Able to explore and examine a site
2. Able to analyze lateral soil pressures acting on to a wall
3. Able to determine bearing capacity of a soil using different theories at different conditions
4. Able to analyze various dynamic forces
5. Able to design a special foundations for vibrating machinery
6. Able to understand Indian codal specification for analysis and design of foundations for dynamic conditions

UNIT-I: Sub–Soil Investigation and Sampling:

Introduction; Methods of exploration; Methods of Boring; Soil Samples; Soil samplers and Sampling; Number and disposition of trial pits and borings; Depth of exploration; Ground water observations; Field test, Laboratory tests; Plate load test; Penetrometer tests; Geophysical methods.

UNIT-II: Shallow Foundations:

Concept of foundations; Types of foundations and their applicability; General requirements of foundations; Location and Depth of foundation, Bearing Capacity & Settlement Methods for bearing capacity estimation, total and differential settlements of footing and raft, code provisions. Design of individual footings, strip footing, combined footing.

UNIT-III: Deep Foundations:

Pile Foundations Estimation load carrying capacity of single and pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), settlement of pile foundation, code provisions, design of single pile and pile groups, and pile caps

Well Foundations Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

UNIT-IV: Lateral Earth Pressure & Retaining Walls:

Introduction; Effect of wall movement on Earth Pressure; Earth Pressure at rest; Rankine's theory of Earth pressure; Coulomb's theory of earth pressure; Culmann's graphical method for active earth pressure; Types of retaining walls, Design of cantilever retaining wall, design of cantilever sheet pile wall, design of anchored sheet pile wall.

UNIT-V: Dynamic Soil Properties:

Stresses in soil element; Determination of dynamic soil properties; Field tests; Laboratory tests; Model tests; Stress-strain behavior of cyclically loaded soils; Cyclic plate load test; Liquefaction.

Machine Foundations

Types of machines; Basic design criteria; Methods of analysis; Mass-Spring-Dashpot model; Elastic-Half-Space theory; Tschebotarioff's reduced natural frequency method; Types of foundations; Modes of vibrations; Vertical, sliding, torsional (yawing) and rocking (and pitching) modes of oscillations; Design guidelines as per codes; Typical design problems.

TEXT BOOKS:

1. Bowles, J.E., "Foundation Analysis and Design", 4th ed., McGraw-Hill Publishing company, Newyork, 1988.
2. Manoj Datta, Shashi K Gulhati,, "Geotechnical Engineering", Tata McGraw – Hill Education (2005).
3. K. R. Arora, "Soil Mechanics and Foundation Engineering", 7th ed., Standard Publishers and Distributors, Delhi, 2009.
4. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Soil Mechanics and Foundation", 16th ed., Laxmi Publications Pvt. Ltd., New Delhi, 2005.
5. P. Srinivasalu, C. V. Vaidyanathan, "Handbook of Machine Foundations" 1st Edition Tata McGraw - Hill Education (2004).

REFERENCES

1. B. J. Kasmalkar, "Foundation Engineering", 6th ed., Pune Vidyarthi Griha Prakashan, Pune, 1989.
2. Dass, B.M, "Principles of Geotechnical Engineering", 5th ed., Thompson books, Singapore, 2002.