

Course Number: CE513

Course Name: Advanced Foundation Engineering

Credits: 3-0-0-3

Prerequisites: Geotechnical Engineering II (CE402) or Equivalent

Intended for: UG/PG

Distribution: Discipline Elective

1. Preamble:

Any civil engineering structure requires a foundation to transfer the superstructure load safely to the underlying soil. In this regard, it is important to estimate the bearing capacity of the soil and settlement of the foundation under the applied load. The proposed course discusses various bearing capacity theories for both shallow and deep foundations in details and it includes special scenarios like foundations resting on layered soil and sloping ground etc. It also deals with the estimation of settlement of such foundations and associated design principles.

2. Course Modules with Quantitative Lecture Hours:

Module 1: Bearing Capacity Theories for Shallow Foundation (4 hours)

Foundation classification, choice of foundations; Field investigations, soil data and design parameters; Bearing capacity theories, influence of water table, soil compressibility, inclined loading, one-way and two-way eccentricity on the bearing capacity of soil.

Module 2: Bearing Capacity for Special Cases (4 hours)

Bearing capacity for special cases of shallow foundations: foundations resting on layered soil, foundations supported by a soil with rigid base, foundations on sloping ground, closely placed foundations.

Module 3: Allowable Bearing Capacity and Settlement of Foundations (5 hours)

Vertical stress increase in a soil mass caused by different types of foundation load; Elastic settlement of foundations, settlement of sandy soil: use of strain influence factor and field test data; Consolidation settlement; Allowable bearing capacity from field load test; Rigid and flexible foundations, contact pressure and settlement distribution beneath footings; Construction issues such as dewatering methods and underpinning of shallow foundations; Foundations on difficult soil: collapsible soils, expansive soils, and sanitary landfills.

Module 4: Mat Foundations (7 hours)

Combined footings, mat/raft foundation; Bearing capacity and settlement of mat foundation; Design of mat foundation: rigid and flexible methods; Buoyancy raft or floating foundation; Skirted foundation.



Module 5: Pile Foundations

(18 hours)

Deep foundations; Load transfer mechanism for pile foundation, estimation of pile capacity, settlement of pile; Small strain and large strain dynamic tests in piles; Pile foundation design subjected to compressive load, uplift, lateral load; Design of pile groups; Pile raft; Concept of negative skin friction; Construction issues related to pile foundation, effect of adjacent constructions on existing pile foundation.

Module 6: Other Types of Deep Foundations

(4 hours)

Well foundations, classification, physical characteristics: shape, size, scour depth, components of well foundations, allowable bearing pressure, forces acting on well foundation and its lateral stability; An introduction to caisson foundation: mechanism, type and construction.

3. Text Book:

- (iii) B.M. Das, Principles of Foundation Engineering, Cengage Learning, 2013.
- (iv) N.N. Som and S.C. Das, Theory and Practice of Foundation Design, Prentice-Hall of India Pvt.Ltd, 2004.

4. References:

- (x) Joseph Bowles, Foundation Analysis and Design, McGraw Hill Education, 2017.
- (xi) J.H. Atkinson, The Mechanics of Soils and Foundations, CRC Press, 2007.
- (xii) Muni Budhu, Soil Mechanics and Foundations, John Wiley & Sons, Inc., 2010.
- (xiii) B.M. Das, Shallow Foundations: Bearing Capacity and Settlement, CRC Press, 2019.
- (xiv) Michael Tomlinson and John Woodward, Pile Design and Construction Practice, CRC Press, 2014.

5. Similarity Content Declaration with Existing Courses:

Sl. No.	Course Code	Similarity Content	Approximate % of Content
1	CE402	Basic concept of bearing capacity, settlement and introduction to different types of foundations	<25%

6. Justification for new course proposal if cumulative similarity content is > 30%:

Not Applicable.

Approvals:

Other faculty interested in teaching this course: Dr. Kala Venkata Uday and Dr. Ashutosh Kumar.



Proposed by: Dr. Mousumi Mukherjee

School: School of Engineering (SE)

Signature: *Mousumi Mukherjee*

Date: 30/09/2020

Recommended / Not Recommended, with comments:

Chairman, CPC

Date:

Approved / Not Approved

Chairman, Senate

Date:

