

Branch Name:	CIVIL ENGINEERING
Program Code:	ET106
Course Title:	Foundation Engineering
Course Code:	2ET1060509T
Pre-requisite Course:	Basic knowledge of soil mechanics

Course Objectives:

- To understand the types of foundations, methods of exploration for subsurface investigations and different soil penetration tests.
- To provide basic knowledge to carry out field investigations.
- To study about types, Bearing Capacity and settlement of Shallow Foundation, Pile Foundation & Machine Foundation.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	-	4	24	60	16	40	-	-	-	-	100

Course Contents:

Unit No	Topic	Total Hours	Weight age (%)
01	Subsurface Investigation Objectives of exploration, Planning of exploration program, soil samples and soil samples, Field Penetration Tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log and report writing.	2	5
02	Basics of foundation Introduction, types of foundation, Factors affecting the selection of type of foundations, Steps in choosing types of foundation, RQD.	2	5
03	Shallow Foundation Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton), Bearing capacity determination using IS Code, Presumptive bearing capacity. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity by use of penetration test data and by plate load test. Bearing capacity of raft. Factors affecting bearing capacity including Water-Table. Contact pressure under rigid and flexible footings. Floating foundation.	10	25

04	Pile foundation Introduction, load transfer mechanism, types of piles according to their composition, their method of installation and their load carrying characteristics, Piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), Penetration test data & Pile load test. Pile group: carrying capacity, efficiency and settlement. Negative skin friction. Under-reamed pile foundation-its concept, design & field installation.	10	25
05	Retaining walls and Diaphragm walls Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls etc.), Analysis of retaining and diaphragm walls	4	7
06	Foundations on problematic soil & Introduction to Geo-synthetics : Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures. Stone Column. Introduction to geo-synthetics-types and uses.	4	8
07	Introduction to Machine foundation Design Criteria for Machine Foundations, Categories of Machine Foundation, Types of machine foundations, Dynamic response of machine foundation, Effect of shape, size, and moment of inertia, Effect of finite depth of stratum over bedrock, Effect of embedment:	10	25

List of Text and Reference Books:

1. Soil Mechanics & Foundation Engineering –B.C. Punamia, Laxmi Pub. Pvt. Ltd., Delhi.
2. Soil Mechanics & Foundation Engineering –K.R. Arora, Standard Pub., Delhi.
3. Soil Mechanics & Foundation Engineering – Alam singh, CBS Publishers & Distributors, Delhi.
4. Soil Mechanics & Foundation Engineering – V. N. S. Murthy, CRS Press, Taylor & Francis Group, New York.
5. Basic and applied soil mechanics – Gopal Ranjan, A.S.R. Rao, New age int. (p) ltd.
6. Principles of Geotechnical Engineering – Braja M Das, Thomson Asia Pvt. Ltd.
7. Soil Mechanics and Foundation Engineering – P. Purushothama Raj, Pearson Education.

E-Resources:

1. <http://nptel.ac.in/>
2. <http://ocw.mit.edu/courses/civil-and-environmental-engineering/>

Course Learning Outcomes (CLO):

1. Investigate soil parameter for the selection of type of foundation as per codal guidelines.
2. Design appropriate foundation for different structures.
3. Design vertical piles and pile groups for various types of loading, soil conditions and settlement requirements.
4. Design and analyze retaining walls, sheet piles and diaphragm walls under static loads
5. Suggest suitable type of geo-synthetics for various foundation issues and its proper implications.
6. Design of machine foundation.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Investigate soil parameter for the selection of type of foundation as per codal guidelines.	L-1
CLO2	Design appropriate foundation for different structures.	L-6
CLO3	Design vertical piles and pile groups for various types of loading, soil conditions and settlement requirements.	L-5
CLO4	Design and analyze retaining walls, sheet piles and diaphragm walls under static loads	L-5
CLO5	Suggest suitable type of geo-synthetics for various foundation issues and its proper implications.	L-4
CLO6	Design of machine foundation	L-5

L1- Remember, **L2-** Understand, **L3-** Apply, **L4-** Analyze, **L5-** Evaluate, **L6-** Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CLO1	H	M		M											
CLO2	H	H	H		H	H		H				H	H	H	H
CLO3	H	H	H		H	H		H					H	H	H
CLO4	H	H	H		H	H		H					H	H	H
CLO5	H	H	M	M	H										
CLO6	H	H	H		H	H		H					H	H	H

H: High, **M:** Medium, **L:** Low