FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University
Marwadi Chandarana Group

Foundation Engineering

01CI0609

Objective of the Course:

- To study soil behavior, determination and interpretation of soil parameters, determination of stresses in soil.
- To provide students with exposure to the systematic methods for designing foundation.
- To gain basic knowledge on foundation selection, foundation forces and its stability under various forces.
- To understand the behavior of various problematic soils.

Credit Earned: 04

Prerequisite: Basics of Geology & Geotechnical Engineering, Advanced Geotechnical Engineering.

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Determine the Soil bearing capacity of shallow foundation using IS code and various methods.
2. Select and apply appropriate soil investigation and testing techniques to accurately determine sub-soil parameters
3. Identification of problematic soil and classify the foundations as per load-carrying mechanisms
4. Design and analyze retaining walls and pile foundation under static loads.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	00	02	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No	Topic name	Hours
1	**Selection of foundation and Sub - soil exploration/investigation:**	**06**
	1.1 Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, Objectives and Planning of exploration program	2
	1.2 methods of exploration - wash boring and rotary drilling - depth of boring, soil samples and soil samplers - representative and undisturbed sampling, field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log and report writing, data interpretation.	4
2	**Shallow Foundation:**	**11**
	2.1 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,	6
	2.2 Bearing capacity from in-situ tests (SPT, SCPT, PLATE LOAD), Factors affecting bearing capacity including Water Table., Bearing capacity of raft/mat foundation as per codal provisions, Contact pressure under rigid and flexible footings. Floating foundation.	5
3	**Pile Foundation**	**10**
	3.1 Introduction, load transfer mechanism, types of piles and their function, factors influencing the selection of pile, their method of installation and their load-carrying characteristics for cohesive and granular soils	2
	3.2 piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911).	4
	3.3 Pile group: carrying capacity, efficiency and settlement. Negative skin friction.	4
4	**Foundations on Problematic Soil & Introduction to Geosynthetics**	**9**
	4.1 Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures.	2
	4.2 Under-reamed pile foundation, concept, design & field installation. Significant characteristics of silt and loess	4
	4.3 Introduction to geosynthetics-types and uses.	3
5	**Retaining wall**	**06**
	5.1 Types of retaining (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging).	06
	TOTAL	**42**

List of Experiments

Sr. No	Topic name
1	Plate load test (PLT)
2	Cyclic Plate Load Test
3	Standard Penetration test (SPT)
4	Static Cone Penetration test (SCPT)
5	Dynamic Cone Penetration test (DCPT)
6	Pile Load Test
7	Lateral Pile Load Test
8	Pull out Test of Pile
9	Electrical Resistivity Test
10	Block Vibration Test
11	Sub surface investigation - Phase – 1: Site Planning
12	Sub surface investigation - Phase – 2: Sampling
13	Sub surface investigation - Phase – 3: Testing Schedule
14	Sub surface investigation - Phase – 4: Report Preparation

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	30%	30%	15%	10%

Instructional Method and Pedagogy:

1 Prerequisite of the course and its pattern shall be discussed on the commencement of the course.
2 Lectures shall be conducted in class room using various teaching aids.
3 Presence in all academic sessions is mandatory which shall carry 5% marks of the total internal evaluation.
4 At the end of each unit/topic an assignment based on the course content shall be given to the students which shall carry 5% weightage for timely completion and submission of the assigned work.
5 The laboratory experiments are planned in such a way that it covers the practical aspects of the course contents. The performance of these experiments shall bring the clarity of the theoretical concepts which the students have studied during the academic sessions.

Recommended Study Material

1. Satish Chandra and M.M. Agrawal, Railway Engineering, Oxford University Press, New Delhi.
2. Mechanics and Foundation Engineering; Pearson Education.
3. B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
4. Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
5. Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai
6. V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore
7. Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.
8. Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
9. Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
10. Code of practice for determination of bearing capacity of shallow foundation IS:6403
11. Code of practice for design and construction of pile foundation- IS:2911 (Part I to IV)
12. Method for standard penetration test for soil- IS:2131
13. Code of practice for subsurface investigation for foundation- IS:1892
14. Code of practice for structural safety of buildings: Shallow Foundations- IS:1904
15. Code of practice for calculation of settlement of foundations- IS:8009

Web Links

1. https://archive.nptel.ac.in/courses/105/105/105105176/
2. https://archive.nptel.ac.in/courses/105/105/105105185/