Marwadi University
Marwadi Chandarana Group

Bachelor of Technology

Civil Engineering

Advanced Geotechnical Engineering

01CI1510

Objective of the Course:

- To carry out laboratory compaction and in-place density tests for fill quality control.
- To determine shear strength of soil for geotechnical purpose.
- To understand and determine the stability failure of slopes and importance of earth pressure.
- To understand and determine the permeability of soil.

Credit Earned: 04

Prerequisite: Basics of Geology & Geotechnical Engineering

Student's learning outcomes:

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

1. Evaluate to predict the stresses incurred on the soil due to overlaying of foundations
2. Predict stability of the slope and Design of slopes that are required in the construction of embankments, earth dams, and canals can be successfully applied
3. Understand the phenomena of compaction & consolidation, also be able to calculate the settlement of the foundation.
4. Calculate the strength, Earth pressure, and permeability parameters of soil as per relevant IS code and phenomena of earth pressure.

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.	Title of the Unit	Number of hours
1	**Compaction**	**05**
	Definition, theory of compaction, Light and Heavy Proctor Compaction Test, factors affecting compaction in the field.	02

	Effect of compaction on soil properties, Zero Percent Air Void Line, Placement water content, Placement layer thickness, field control of compaction.	03
2	**Consolidation**	**07**
	Compressibility of Soils. Definition and Mechanism of Soil, Consolidation, Terzaghi's Spring Analogy	02
	Compression Index, Coefficient of Compressibility, Coefficient of volume change. Derivation of Terazagi's One-Dimensional Consolidation Equation. Time factor and consolidation ratio.	02
	Calculation of consolidation settlement for uniform pressure increment in the clay layer. One Dimensional consolidation test.	03
3	**Shearing Resistance and Strength**	**06**
	Mohr's strength theory, Mohr-Coulomb strength theory, Modified Mohr-Coulomb strength theory, Types of tri-axial tests-UU, CU, CD.	03
	Direct shear test, Unconfined compression test, Vane shear Test, Effective Stress principle.	03
4	**Stability of Slopes**	**06**
	Idealized Condition used in the analysis, factor of safety, Infinite and finite slopes, Stability of Infinite slopes.	02
	Introduction to Swedish Circle Method of Analysis, Taylor's Stability Number.	02
	Slopes stability analysis using Swedish circle method, Bishop's method.	02
5	**Earth Pressure**	**05**
	Types of lateral earth pressure, Rankine's and Coulomb's earth pressure, Theory, and their application for determination of lateral earth pressure under different conditions.	02
	Rebhann's and Culmann's Graphical methods of determination of lateral earth pressures.	03
6	**Stress Distribution of Soils**	**07**
	Causes of stress in soil, geostatic stress, Boussinesque's equation, stress distribution diagrams.	03
	New-mark's influence chart Westergard's equation, stresses due to circular and rectangular loadings.	04
7	**Permeability and Seepage**	**06**
	Darcy's Law and its validity, factors affecting permeability, Constant head and Falling Head Permeability Test	03
	Permeability of stratified soil masses, Seepage pressure, Quicksand condition, Flow Net and its characteristics.	03
	Total	**42**

List of Experiments

Sr. No.	Topic Name
1	Standard Proctor Compaction Test
2	Modified Proctor Compaction Test
3	Consolidation Test
4	Direct Shear Test
5	Demonstration on Triaxial Test – CD Test
6	Demonstration on Triaxial Test – CU Test
7	Demonstration on Triaxial Test – UU Test
8	Unconfined Compression Test
9	Free Swell
10	Swelling Pressure Test
11	Falling Head Permeability Test
12	Constant Head Permeability Test

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
20%	20%	20%	25%	15%	00%

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 classroom 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. Soil Mechanics & Foundation Engineering by B.C. Punmia; Laxmi Pub. Pvt. Ltd.
2. Soil Mechanics & Foundation Engineering by K. R. Arora; Standard Publication
3. Soil Mechanics & Foundation Engineering by P. Purushothama Raj; Pearson Publication
4. Fundamentals of Soil Mechanics by D. W. Taylor; Asia Publishing House
5. Principles of Geotechnical Engineering by B. M. Das; Thomson Asia Pvt. Ltd.