INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (CIVIL ENGINEERING)**
SEMESTER	**5**
COURSE TITLE	**ADVANCED GEOTECHNICAL ENGINEERING**
COURSE CODE	**01CI1510**
COURSE CREDITS	**4**

Objective:

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

Course Outcomes: After completion of this course, student will be able to:

1 Describe and Apply principles of soil compaction and enhance engineering performance of soil in the field
2 Determine shear strength, settlement of Foundation and permeability of soil using theoretic equation.
3 Analyze earth pressure, assess slope stability using various theories and predict soil stresses caused by foundation loads using theoretical methods.
4 Evaluate soil parameters for permeability and seepage, shear strength and consolidation through laboratory tests

Pre-requisite of course: Basics of Geology & Geotechnical Engineering

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Compaction** Definition, theory of compaction, Light and Heavy Proctor Compaction Test, factors affecting compaction in the field., Effect of compaction on soil properties, Zero Percent Air Void Line, Placement water content, Placement layer thickness, field control of compaction	5

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

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment-1** Standard Proctor Compaction Test	2
2	**Experiment-2** Modified Proctor Compaction Test	2
3	**Experiment-3** Consolidation Test	4

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	**Experiment-4** Direct Shear Test	2
5	**Experiment-5** Demonstration on Triaxial Test CD Test	4
6	**Experiment-6** Demonstration on Triaxial Test CU Test	2
7	**Experiment-7** Demonstration on Triaxial Test UU Test	2
8	**Experiment-8** Unconfined Compression Test	2
9	**Experiment-9** Free Swell index	2
10	**Experiment-10** Swelling Pressure Test	2
11	**Experiment-11** Falling Head Permeability Test	2
12	**Experiment-12** Constant Head Permeability Test	2
Total Hours		**28**

Textbook :

1 Soil Mechanics & Foundation Engineering, B.C. Punmia, Laxmi Pub. Pvt. Ltd., 2017

References:

1 Soil Mechanics & Foundation Engineering, Soil Mechanics & Foundation Engineering, K. R. Arora, Standard Publication, 2019

2 Soil Mechanics & Foundation Engineering, Soil Mechanics & Foundation Engineering, P. Purushothama Raj, Pearson Publication, 2008

3 Fundamentals of Soil Mechanics, Fundamentals of Soil Mechanics, D. W. Taylor, Asia Publishing House, 2020

4 Principles of Geotechnical Engineering, Principles of Geotechnical Engineering, B. M. Das, Thomson Asia Pvt. Ltd., 2015

Suggested Theory Distribution:

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

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
20.00	20.00	20.00	25.00	15.00	0.00

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Instructional Method:

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

Supplementary Resources:

1. https://nptel.ac.in/courses/105/103/105103097/
2. http://civilbookfree4you.blogspot.com/2018/06/soil-mechanic-foundation-books-e.html
3. https://civilenggforall.com/geotechnical-engineering-made-easy-gate-handwritten-notes-pdf/
4. https://lecturenotes.in/subject/603/soil-mechanics-sm
5. https://gradeup.co/civil-engineering-exams/soil-mechanics
6. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-361-advanced-soil-mechanics-fall-2004/lecture-notes/