



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

GEOLOGY AND SOIL MECHANICS LABORATORY								
IV Semester: CE								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ACEE17	Core	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			
Prerequisite: Nil								

I. COURSE OVERVIEW:

This laboratory course provides hands-on experience in engineering geology and soil mechanics to develop skills in identifying geological materials, interpreting geological structures, and performing standard geotechnical tests. Students will learn to classify rocks and minerals, prepare and interpret geological maps, and evaluate structural features relevant to civil engineering. The soil mechanics component covers determination of index, engineering, and strength properties of soils through laboratory and field tests, enabling the application of theoretical principles to real-world geotechnical problems.

II. COURSE OBJECTIVES:

The students will try to learn:

- I Techniques for identification and classification of common rocks and minerals relevant to civil engineering works.
- II Methods for interpreting geological maps and recognizing structural features such as folds, faults, and joints.
- III Principles and procedures for conducting soil index property tests, including moisture content, specific gravity, Atterberg limits, and grain size distribution.
- IV Laboratory and field methods for determining permeability, compaction characteristics, consolidation properties, and shear strength of soils.
- V Procedures for evaluating bearing capacity and load–deformation characteristics of subgrades and foundation soils.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO 1 Identify and classify common rock and mineral specimens based on physical properties and engineering relevance.
- CO 2 Interpret geological maps and structural features for use in site investigation and civil engineering planning.
- CO 3 Determine soil index properties (moisture content, specific gravity, Atterberg limits, grain size) and classify soils using IS standards.
- CO 4 Evaluate soil permeability, compaction characteristics, and consolidation parameters for engineering applications.
- CO 5 Analyze the shear strength of soils under different drainage conditions using direct shear, triaxial, and vane shear tests.
- CO 6 Assess subgrade performance using California Bearing Ratio (CBR) and other bearing capacity-related tests.

IV. COURSE CONTENT:

EXERCISE – I: INTRODUCTION AND IDENTIFICATION OF MINERALS

Identify and classify common rock-forming and ore minerals using physical properties such as color, hardness, streak, luster, cleavage, and specific gravity.

EXERCISE – 2: IDENTIFICATION OF ROCKS & INTERPRETATION OF GEOLOGICAL MAPS

Classify common igneous, sedimentary, and metamorphic rocks; study geological maps and recognize features such as dips, strikes, folds, and faults.

EXERCISE – 3: DETERMINATION OF MOISTURE CONTENT OF SOILS

Determine the natural moisture content of a given soil sample.

EXERCISE– 4: DETERMINATION OF SPECIFIC GRAVITY OF SOILS

Determine the specific gravity of soil fraction passing 4.75 mm IS sieve using the density bottle method.

EXERCISE – 5: DETERMINATION OF ATTERBERG LIMITS OF SOILS

Determine the liquid limit, plastic limit, and shrinkage limit of soil; calculate flow index and toughness index.

EXERCISE – 6: DETERMINATION OF FIELD DENSITY – CORE CUTTER AND SAND REPLACEMENT METHOD

Determine the in-situ density of soils using core cutter and sand replacement methods.

EXERCISE – 7: GRAIN SIZE ANALYSIS OF SOILS

Classify coarse-grained soils based on sieve analysis results.

EXERCISE – 8: PERMEABILITY OF SOIL – CONSTANT HEAD AND VARIABLE HEAD TESTS

Determine the coefficient of permeability of a soil sample at desired density using suitable methods.

EXERCISE – 9: DETERMINATION OF OMC AND MDD – COMPACTION TEST

Determine the optimum moisture content and maximum dry density of soil using the Proctor compaction test.

EXERCISE – 10: DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Determine the CBR value by conducting a load penetration test in the laboratory.

EXERCISE – 11: DETERMINATION OF CONSOLIDATION PARAMETERS

Determine the settlements due to primary consolidation of soil using the one-dimensional consolidation test.

EXERCISE – 12: UNCONFINED COMPRESSION TEST

Determine the unconfined compressive strength and sensitivity of cohesive soils.

EXERCISE – 13: TRIAXIAL COMPRESSION TEST

Determine shear strength parameters (cohesion, angle of shearing resistance) under different drainage conditions.

EXERCISE – 14: DIRECT SHEAR TEST & VANE SHEAR TEST

Determine shear strength parameters of soil using the direct shear test; determine the undrained shear strength of clay using the vane shear test.

V. TEXTBOOKS:

1. Parbin Singh. *Engineering and General Geology*. 8th Edition, S.K. Kataria & Sons, 2010. (Geology)
2. Das, B. M. *Soil Mechanics Laboratory Manual*. Engineering Press at OUP, 2021.
3. Kalinski, Michael E. *Soil Mechanics: Lab Manual*. 2nd Edition, John Wiley & Sons, 2011.
4. Ventura Tejada, Fernando R. *Soil Mechanics Laboratory Manual*. 2020.

VI. REFERENCE BOOKS:

1. Blyth, F. G. H., and M. H. De Freitas. *A Geology for Engineers*. 7th Edition, CRC Press, 2017. (Geology)
2. Das, B. M., and N. Sivakugan. *Fundamentals of Geotechnical Engineering*. Cengage Learning, 2016.
3. Murthy, V. N. S. *Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering*. CRC Press, 2002.

VII. ELECTRONICS RESOURCES:

1. <http://home.iitk.ac.in/~madhav/geolab.html>
2. <https://nptel.ac.in/courses/105/101/105101160/>

VIII. MATERIAL ONLINE:

1. Course outline description
2. Laboratory manual