



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2026-II

1. COURSE

CE2G1. Soil Mechanics I (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE2G1. Soil Mechanics I
2.2 Semester	: 7 th Semester.
2.3 Credits	: 4
2.4 Hours	: 3 HT; 2 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: • CE1G1. General Geology. (2nd Sem) • CE2M1. Mechanics of Materials I. (4th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Soil Mechanics I introduces the future civil engineer to soil as an engineering material, building on the descriptive foundations established in General Geology. The course develops the phase-relationship framework used to describe the state of a soil, the classification systems (USCS and AASHTO) used to communicate its expected engineering behavior, the theory and field control of compaction as the primary tool for improving earthwork properties, and the hydraulic behavior of soils — permeability, seepage, capillarity, and effective stress — that governs the interaction between water and the soil skeleton in geotechnical design. The course closes with an introduction to subsurface exploration and sampling methods, providing the field basis on which the laboratory characterization covered earlier in the course, and the subsequent Geotechnical Engineering sequence (Soil Mechanics II, Foundations, Earth Retaining Structures), are built.

5. GOALS

- Calculate phase relationships and index properties of soils from laboratory data, and relate the origin and formation of soil deposits to their expected engineering behavior.
- Classify soils according to the USCS and AASHTO systems from particle size distribution and Atterberg limit test results.
- Apply compaction theory to specify and control earthwork compaction in the laboratory and in the field.
- Determine soil permeability, construct flow nets, and calculate seepage quantities using Darcy's law.
- Explain the effective stress principle and analyze capillarity and frost action in partially saturated soils.
- Select appropriate subsurface exploration, boring, and sampling methods for a geotechnical investigation program.

6. COMPETENCES

ABET-1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (Usage)

ABET-6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (Usage)

7. TOPICS

Unit 1: Phase Relationships and Seepage (66 hours)	
Competences Expected: ABET-1,ABET-6	
Topics	Learning Outcomes
• Phase relationships and index properties of soils • Soil classification systems including USCS and AASHTO • Particle size distribution and Atterberg limits • Compaction theory and field control methods • Permeability and Darcy's law • Seepage analysis and flow nets • Effective stress principle and pore water pressure • Capillarity and soil suction • Frost action and thermal properties of soils	• Calculate phase relationships and derive index properties from laboratory data [Usage] • Classify soils according to USCS and AASHTO classification systems [Assessment] • Interpret particle size distribution curves and plasticity charts [Assessment] • Apply compaction theory to field construction control [Usage] • Determine soil permeability using laboratory and field methods [Assessment] • Construct flow nets and calculate seepage quantities [Usage] • Explain the effective stress principle and its engineering significance [Familiarity] • Analyze capillary rise and soil suction effects in partially saturated soils [Assessment] • Evaluate frost susceptibility and design frost protection measures [Familiarity]
Readings : [Das19]	

Unit 2: Site Investigation and In-Situ Testing (4 hours)	
Competences Expected: ABET-6	
Topics	Learning Outcomes
• Investigation planning and scope determination • Boring methods and subsurface exploration techniques • Sampling methods for disturbed and undisturbed samples • Standard Penetration Test and correlations • Laboratory testing program and test selection • Cone Penetration Test and piezocone testing • Vane shear test and pressuremeter testing • Geophysical methods including seismic and resistivity surveys • Groundwater monitoring and piezometer installation • Report preparation and geotechnical data presentation • In-situ permeability (Lugeon/packer) testing for foundation grouting and seepage assessment • Borrow area investigation for embankment fill material quantity and quality	• Develop appropriate site investigation programs based on project requirements [Assessment] • Select appropriate boring and exploration methods for different soil conditions [Familiarity] • Specify sampling techniques to obtain quality samples for testing [Usage] • Interpret SPT data and apply empirical correlations for design parameters [Assessment] • Design laboratory testing programs for geotechnical projects [Usage] • Analyze CPT and piezocone data for soil profiling and parameter evaluation [Assessment] • Apply vane shear and pressuremeter tests for soft clay characterization [Usage] • Utilize geophysical methods to complement traditional investigation techniques [Assessment] • Monitor groundwater conditions and interpret piezometric data [Usage] • Prepare comprehensive geotechnical investigation reports [Assessment] • Perform packer (Lugeon) testing and interpret results for foundation grouting curtain design [Usage] • Characterize borrow areas for embankment fill material quantity and quality [Assessment]
Readings : [Das19]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY

[Das19] Braja M. Das. *Principles of Geotechnical Engineering*. 9th. Cengage Learning, 2019.