UNICUSANO
ROME

Code: ICAR/07 **Credits: 9**
Matter: Fundamentals of soil mechanics
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
Prof. Riccardo Conti - riccardo.conti@unicusano.it

Introduction

1. *Objective of the course:*

The course is an introduction to fundamentals of soil mechanics and applications of its principles to the engineering practice.
Some of the important topics that students will learn during the course are: identification and classification of soils for engineering purposes; physical and engineering properties of soils; groundwater and seepage through soils; fundamental behavior of soils under different loading and boundary conditions; consolidation; compressibility and shear strength of soils.
Upon successful completion of the course, students should be able to apply fundamentals of soil mechanics and principles of geotechnical engineering in the analysis and design of civil engineering projects.

Objectives

2. *Course Structure:*

The course is organized in seven modules. The first module is focused on the identification and classification of soils. The second module is devoted to a brief recall of fundamentals of continuum mechanics. The third module provides the concept of effective stress for soils. The fourth module is focused on the computation of the geostatic stress state in soil deposits. The fifth module presents the fundamental concepts of groundwater and seepage through soils. The sixth module is focused on the consolidation theory and the compressibility of soils. Finally, the seventh module introduces the concept of strength of soils and its definition through ad hoc laboratory tests.

The knowledge acquired in theory lessons will be applied in the "virtual classroom" forum through nine activities, consisting in the solution of simple practical problems (E-tivity).

Competencies:

- knowledge of systems for the identification and classification of soils.
- knowledge of the main physical and engineering properties of soils and their definition through ad hoc laboratory tests.
- knowledge of the concept of effective stress for soils.
- knowledge of the effects related to groundwater and seepage through soils.
- knowledge of the consolidation theory.
- knowledge of compressibility and strength properties of soils and their definition through laboratory tests.

Syllabus

3. *Programme of the course:*

Subject 1. Identification and classification of soils

Proposed topics: Formation and structure of soils; Granular and cohesive soils; Description and classification of soils.

Subject 2. Fundamentals of continuum mechanics

Proposed topics: Stress and strain tensor; Mohr circles of stress; Eigenvalues and Eigenvectors; Balance of linear and angular momentum.

Subject 3. Effective stress for soils

Proposed topics: the principle of effective stress.

Subject 4. Geostatic stress state in soil deposits

Proposed topics: Picture of geological processes: yield stress and overconsolidation ratio; geostatic stresses.

Subject 5. Flow in porous media

Proposed topics: Darcy's law; Coefficient of hydraulic conductivity; Drained and undrained conditions; Mathematical modelling of flow in porous media; Steady state flow.

Subject 6. Consolidation theory and the compressibility of soils

Proposed topics: Transient flow: one-dimensional theory of consolidation; Solution of consolidation; Oedometer test; Experimental determination of the coefficient of consolidation; Soil compressibility.

Subject 7. Shear strength of soils

Proposed topics: Soil strength and Coulomb's failure criterion; Soil testing: requirements of laboratory apparatuses; Dilatancy, peak and critical state strength; State paths: drained and undrained tests on reconstituted samples.

Evaluation system and criteria

The exam consists of a written test, which normally includes 1-2 numerical exercises and 1 theoretical question on the main topics covered in the course.
During the written test, it is NOT allowed to use handouts, notes, texts or forms.
E-tivities are evaluated from 0 to 4 points, while 0-26 points are assigned to the written test.

Bibliography and resources

4. *Materials to consult:*
   The educational materials (lecture notes, slides and video lessons) are available on the Unicusano platform.

5. *Recommended bibliography:*
   Lancellotta R. (2008), "Geotechnical Engineering", Taylor & Francis Ed.