Soil Mechanics II

Application of elastic continuum theory: stresses and strains in soil masses under external loading. Plane-strain and axis-symmetric loading. The St. Venant principle. Horizontal earth pressures under different loading conditions. Rankine and Coulomb methods. Gravity retaining walls. The role of elastic deformations. Limit equilibrium methods in soil mechanics. Slope stability under drained and undrained conditions. Ultimate load of foundation (bearing capacity). Ground water flow in one dimension. Evolution in time of excess pore water pressures and consolidation of a clay layer due to vertical external loading.

- Semester 5
- Teaching hours 4
- Instructors A. Papadimitriou **(Coordinator)** ● N. Gerolimos ● V. Georgiannou ● M. Pantazidou

Prerequisite Knowledge

Soil Mechanics I

Course Units

	Title	Description	Hours
1	Introduction	Applications of Soil Mechanics II in Geotechnical Engineering.	1X4=4
2	Elements of Stress Analysis	Mechanical stress-strain behaviour of soil. Stresses induced by the self weight of soil. Stresses and strains in soil masses under external loading. The states of plane strain and axisymmetric deformation. The St. Venant principle. Stress distribution in a two-layered half-space.	2X4=8
3	Lateral Earth Pressure	Active and Passive earth pressure: The transition from elasticity to yielding. The Rankine's theory for estimating the lateral earth pressures. Gravity earth retaining structures. Limit equilibrium method in Soil Mechanics. The Coulomb's wedge theory for lateral earth pressures.	2X4=12
4	Stability of Slopes	The limit equilibrium method for calculating the factor of safety against slope failure. Planar and circular types of failure. Total and Effective stress analysis. Introduction to the method of slices.	2X4=12
5	Bearing Capacity of Soil	Limit equilibrium methods for the determination of the ultimate bearing capacity of a foundation: The slip circle method.	2X4=16
6	Flow of Water through Soil	Darcy's law of saturated flow. Determination of the coefficient of permeability (in the laboratory and in the field), the hydraulic gradient and critical hydraulic gradient. Flow nets and seepage quantities. The quicksand failure mechanism.	2X4=16

	Title	Description	Hours
7	One Dimensional Consolidation	Soil behaviour for drained and undrained load conditions. Excess pore water pressure development and dissipation. Consolidation-induced settlements.	2X4=16

Learning Objectives

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

Recognize how the behaviour in the micro-scale (at soil element level) affects the response in the macro-scale (boundary-value problem level). Understand the significance of water flow through soil on the behaviour of soil and the response of Geotechnical systems and structures.

Teaching Methods

Teaching methods	In class lectures, Solving of examples and applications in class, Discussion of case studies.
Teaching media	Blackboard presentations and Power Point Slide Projection.
Laboratories	Small-scale experiment to study the quicksand failure mechanism.
Problems - Applications	In-Class exercises.

Student Assessment

- Final written exam: 70%
- Mid-term exam: 30%

Textbooks - Bibliography

1. Textbook 1: Gazetas G., Notes of Soil Mechanics (in Greek).
2. Textbook 2: Georgiadis K. & Georgiadis M., Elements of Soil Mechanics, Eudoxus Editions, ISBN: 978-960-456-157-5 (in Greek).

Lecture Time - Place: Wednesday, 14:45 – 18:30, Rooms: Αμφ. 1/2 **,** Ζ. Κτ. 1 Πολ., Αιθ. 1, Ζ. Κτ. 1 Πολ., Αιθ. 7