COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MINERAL RESOURCES ENGINEERING		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	MRE401	**SEMESTER**	4th
COURSE TITLE	Geotechnical Engineering and Soil Mechanics		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	5
Laboratory or Tutorials	2	
Overall	4	

COURSE TYPE	Background Course (Special Infrastructure course)
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

This course is aimed at teaching the students the concepts of soil mechanics, including the science and technology of soils and their application to problems in engineering practice.

The course emphasizes the fundamentals and relevant principles of soil mechanics, gives an overall picture of the behaviour of soils and describes the nature of some of the soil problems encountered in engineering.

The course content also aims at understanding the basic principles of Soil Mechanics, the consolidation of knowledge regarding the behavior of the "soil" material and the ability to compute basic problems in classical applications of Soil Mechanics.

Upon successful completion of the course the student will be able to:

- Recognize, understand and be able to classify the basic physical and mechanical properties of soils.
- Distinguish and understand the parameters related to soil behavior issues.
- Calculate the developing stresses in the soil due to the soil self-weight as well as due to external loading, the shear strength of the soil and the stability of soil slopes.
- Combine individual terrain characteristics and to be able to differentiate and adjust the assessment and calculation procedures based on the specific parameters of each case under consideration.
- Understand the parameters and characteristics of the soil that affect its composition, permeability, compressibility and mechanical behavior.
- Apply laboratory methods and in-situ/field tests to determine soil parameters and characteristics, and the suitable soil use, both as a construction material and as a material for accommodating loads of engineering projects and works.
- Organize laboratories for the determination of soil mechanics characteristics and parameters as well as the structure and the engineering behaviour of compacted cohesive and granular soils, compaction specification and field control, Vertical Stress Distribution Diagrams, Calculation of Consolidation Settlement under a Foundation, Methods of Accelerating Consolidation Settlement, Relations between undrained cohesion and effective overburden pressure, etc..

General Competences
The course contributes to the acquisition of the following skills: • Applying knowledge in practice, • Researching, Analyzing & Synthesizing Data & Information using necessary technologies, • Adapting to new situations, • Decision-making, • Working independently, • Working in an international environment, • Working in groups (Teamworking), • Promoting Free, Creative & Inductive thinking, • Project design.

3. SYLLABUS

General: Introductory data. Soil - soil formations. Physical properties of soils. Soil classification systems. Initial or Geostatic stresses (actions). Effect of water flow in Soil Mechanics applications. Ground stresses due to external load. Solidification-Sediments. Shear strength of soil. Bearing capacity of soil. Slope stability. Foundations.

Theory: Physical characteristics. Ground identification. Soil classification. Permeability. Compressibility. Shear strength, cohesion, abrasion. Triaxial strength. Soils with and without cohesion. Active, neutral, passive impulse. Sediments. Allowable settlement stresses (actions). Pressure-sediment diagram. Differential settlement. Solidification. Bearing capacity. Surface foundations. Basement flow. Pumps. Soil improvements, compaction and drainage. etc.

Laboratory exercises: Soil classification, Soil mechanical tests Unobstructed compression, Shear, Solidification, Soil compaction, Method for determination of weight of cohesive materials, Standard method for testing of granularity, Moisture determination of materials with CM test apparatus, Casagrande soil classification, Unobstructed compression test, Direct shear test of cohesive soils , etc.

Summary: Description of the fundamental principles of soil behavior and introduction to soil stresses and deformations as well as soil stability. Introduction to concepts of Theoretical Soil Mechanics in order to use the appropriate soil parameters for each type of problem.

Content of theory lectures:

- Physical and mechanical properties of soils.
- Laboratory measurements and field tests.
- Water flow in porous soils and its effect on the mechanical behavior of the soil.
- Stresses (actions) and deformations in the ground.
- Shear strength of the soil.
- Ground slope stability.

Content of laboratory exercises:

- Introduction to knowledge related to the control and testing of the physical and mechanical properties of soils.
- Laboratory Determination of Soil Moisture.
- Laboratory Determination of Specific & Apparent Weight of soils.
- Granulometric analysis of soils.
- Laboratory Determination of Atterberg Limits (Water Limit, Plasticity Limit, Shrinkage Limit).
- Proctor methods (Soil compaction).
- Determination of Site Construction Density.
- Unhindered Compression Test (Determination of Uniaxial Resistance to Soil Compression).
- Immediate Shear Test (Determination of Shear Strength of Soils).
- Consolidation (Oedometer) Test.

4. TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY</td><td>In the classroom and in the laboratory (Face-to-face).
Webinars. Tutorials. Laboratory demonstrations. Possibility of distance lectures if required via Zoom Cloud Meeting.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td><td>Presentation of lectures using PC (presentations, experimental videos, etc.).
Support of learning process through the electronic platform eLearning and electronic communication with students (Online announcements and comments, forum, email etc.).
Self-assessment questionnaires in the eLearning environment of the course and asynchronous training platform - eclass.
Assistance in completing assignments through result files for each individual student.</td></tr>
<tr><td>TEACHING METHODS</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Laboratory exercises and processing of results with computational procedures</td><td>26</td></tr>
<tr><td>Individual assignments on laboratory exercises & theory (Coursework) and application exercises</td><td>30</td></tr>
<tr><td>Independent Home Study</td><td>48</td></tr>
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<tr><td>Overall Course Set (26 hours of workload per credit unit)</td><td>130</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION</td><td>Written final theory exam that includes:
• Theoretical judgment questions in course subjects (short answer questions and multiple choice questions).
• Problem solving-exercises.
• Solving of laboratory exercises.

Delivery of assignments and oral examination
that includes:
• Laboratory work (processing of results of laboratory exercises).
• Solving of application exercises.
• Examining the understanding of basic concepts.</td></tr>
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5. SUGGESTED BIBLIOGRAPHY

- Sachpazis, C., "Lecture Notes on Soil Mechanics II on topics: 1) Clay Mineralogy, 2) Soil Classification, 3) Phase Relations 4) Soil Compaction, 5) Permeability 6) Shear strength of soils, 7) Consolidation, 8) Lateral Earth Pressures, 9) Geotechnical Site Investigation, and 10) Introduction to Geotechnical Engineering. 2021.
- Komodromos Emilios, Foundations - Supports, 2nd edition, 2019, ISBN: 978-960 -461-952-8, KLIDARITHMOS PUBLICATIONS LTD
- Tsotsos Stefanos, "Soil Mechanics", F. Ververidis and P. Polychronidis Publications Thessaloniki, 1991.
- Bowles, JE, (1997). Foundation Analysis and Design. 5th Edn., McGraw-Hill, New York.
- John Atkinson, «Introduction of Soils and Foundations» Mc Graw Hill, 1993.
- Barnes Graham E. (2014), "Soil Mechanics: Principles and Applications (3rd edition)", Klidarithmos Publications, Athens, ISBN: 978-960-461-578-0
- Kavvadas M. (2016), "Elements of Soil Mechanics (2nd edition)", Tsotras Publications, ISBN: 978-618-5066-62-8
- Koletsos K., (2004), "Geotechnical Engineering", University Studio Press Publications, ISBN: 978-960- 12-1256-2
- Grammatikopoulos I., Andreadou-Manou N., Chatzigogos Th. (2015), "Soil Mechanics: exercises and problems (2nd edition)", Kyriakidis Bros., Thessaloniki, ISBN: 978-618-5105-87-7
- Christaras V., Chatziangelou M. (2011), "Simple steps in Soil Mechanics", University Studio Press, Thessaloniki, ISBN: 978-960-12-1935-6

Related scientific journals:

- Geotechnical Testing Journal
- Journal of Geotechnical and Geoenvironmental Engineering Geotechnique
- Geotechnical and Geological Engineering Canadian Geotechnical Engineering
- Soils and Foundations