COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MINERAL RESOURCES ENGINEERING		
LEVEL OF STUDIES	*Undergraduate*		
COURSE CODE	MRE701	**SEMESTER**	7th
COURSE TITLE	Rock Mechanics – Engineering Geology		

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:	Geology (MRE103) Mechanics - Strength of Materials (MRE302) Geotechnical and Soil Mechanics (MRE401)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	

2. LEARNING OUTCOMES

Learning outcomes

The course aims to the understanding of the basic principles of Rock Mechanics and Engineering Geology, the consolidation of knowledge regarding the behavior of the material "Rock-Material", the overall mass "Rock-Mass" and the ability to analyse and compute basic problems in classical applications of Rock 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 rocks.
- Distinguish and understand the parameters related to issues of rock mass behavior.
- Calculate the developing stresses in the rock material / rock mass due to the self rock weight but also due to external loading as well as the rock material / rock mass shear strength and the stability of rock mass slopes.
- Combine individual terrain/topography characteristics and 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 rock material / rock mass that affect its composition and rock mechanics behavior, as well as the basic background of Engineering Geology and Rock Mechanics and their integration in the projects.
- Apply laboratory methods and field tests to determine the rock material and rock mass parameters and characteristics, and the correct use of the rock, both as a construction material, as well as a material for withstanding loads of engineering works and projects, and organize in-situ and laboratory tests for the determination of rock mechanics characteristics & parameters.
- Assess the geological background and its influence on engineering projects.

General Competences

The course contributes to the acquisition of the following skills:

- Researching, Analyzing & Synthesizing Data & Information using necessary technologies
- Decision-making
- Working independently
- Project design
- Promoting Free, Creative & Inductive thinking.

3. SYLLABUS

- General: Introduction. Applications of geology in the science of Engineering. Engineering Geology and Rock Mechanics. Properties of geological material - intact rock. The rock as a discontinuous medium, Rock mass behaviour. Geotechnical classification of rock material and rock mass. Fieldwork. Geological issues of stability of rock mass slopes and foundations. Engineering Geology of tunnels and underground works. Engineering Geology of dams and reservoirs. Case studies on Geology of Greece in relation to the study and construction of Engineering Projects/Works. Properties, engineering behavior of rocks on engineering works and structures. Introduction to engineering of geological material. Soil, rock material, rock mass. Industrial minerals and rocks. Building stones and materials. Geological processes in earth crust. Earthquakes, crustal deformations and plate tectonics, geological tests. Exogenous geological processes. Decomposition, weathering and erosion. Geomorphology. Engineering land forms. Subsidence. Landslides. Underground water. Aquifers and aquitards. The water cycle in nature. Underground flow. Water resources and exploitation. Pollution. Groundwater and constructions. Interpreting of engineering geological maps and processing data for studies and constructions of engineering projects/works.

- Theory: Introduction to rock mechanics. Introduction to Engineering Geology. Distinction of geological formations. Physical properties of rocks. Laboratory tests on rock material formations. Classification of rock mass (Bieniawski, Barton, GSI, etc.). Correlations between Various Rock Mass Classifications Systems, including Laubscher (MRMR), Bieniawski (RMR), Barton (Q) and Hoek (GSI) Systems. Resistance to compression, tension, shear. Discontinuities and joint sets. Landslides and rock mass slope stability. Foundations in rocks. Stratigraphy, tectonics and foundation of engineering works on a rock mass bedrock. Physical properties of the rock material. Stress conditions of the rock mass. Deformation of the rock mass. Uniaxial compressive strength of intact rock. Resistance of the rock to triaxial compression. Resistance of the rock to tension. Dynamic behavior of the rock mass. Shear strength of rock joints and discontinuities. Strength, deformability and permeability of the rock mass.

- Laboratory exercises:
  - Classification of rock mass.
  - Determination of moisture content of rock samples (E103-84 / 1).
  - Determination of porosity & density of rock samples (E103-84 / 1).
  - Determination of apparent weight (linear method).
  - Preparation of cylindrical rock specimens & determination of the unconfined compressive strength of cylindrical specimen (E103-84 / 4 & ASTM D4543 / 85).
  - Determination of uniaxial (unconfined) compressive strength of a shaped cylindrical specimen & Poisson ratio calculation (EI 03-84 / 4 & ASTM D 3967-95).
  - Determination of the point load strength test of a shaped cylindrical specimen (E103-84 / 1).
  - Splitting Tensile Strength of Intact Rock Core Specimens - Brazilian Test. Rock characterization, testing and monitoring, lSRM suggested methods ET Pergamon Press 1981 (ASTM D3967 / 95).
  - Relaxation test of rock samples by the method of simple immersion in water (Kentucky Method 64-514-02, Colorado Procedure 26-90).
  - Determination of shearing resistance of rock discontinuities. Triaxial test on rock material.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	In the classroom and in the laboratory (Face-to-face). Webinars. Tutorials. Laboratory demonstrations. Possibility of distance lectures if required via Zoom Cloud Meeting.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	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.

TEACHING METHODS	*Activity*	*Semester Workload*
	Lectures	26
	Laboratory exercises and processing of results with computational procedures	26
	Individual assignments on laboratory exercises & theory (Coursework) and application exercises	30
	Independent Home Study	48
	Overall Course Set (26 hours of workload per credit unit)	***130***

STUDENT PERFORMANCE EVALUATION	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.

5. SUGGESTED BIBLIOGRAPHY

- Sachpazis, C., (2019) "Geotechnical Engineering of Dams". Academic Book, 455 Pages, Code in Eudoxus: 77120847. ISBN Code: 978-618-83547-0-8. Ch. Tsapraili Publications © 2019.
- Nomikos, P., 2015. Introduction to rock mechanics. [digital book] Athens: Association of Greek Academic Libraries. Available at: http://hdl.handle.net/11419/3983
- Koukis G., Sampatakakis N., Geology of Engineering Works, Book Code in Eudoxus: 9709, Edition: 2nd ed./2007, ISBN: 978-960-7530-95-0, Type: Book, Distributor (Publisher): A. PAPASOTIRIOU & CO OE.
- Engineering Geology, Bandis S., 2008, G. DARDANOS-K Publications. DARDANOS OE., Book Code in Eudoxus: 32070.
- Bieniawski, ZT (1984). "Rock Mechanics Design in Mining and Tunneling". AA Balkema, 272p.
- Brady, BHG, Brown, ET (2004). "Rock Mechanics for underground mining". Kluwer Academic Publishers, 628p.
- Hoek, E. (2014). "Practical Rock Mechanics". http://www.rocscience.com/hoek/pdf/Practical_Rock_Engineering.pdf, 237p.
- Resat Ulusay, 2014, The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 2007-2014. The ISRM Commission on Testing Methods. Springer.