

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE (LEVEL 7)		
COURSE CODE	FE0301	SEMESTER	8 th
COURSE TITLE	ENGINEERING GEOLOGY AND ROCK MECHANICS		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		WEEKLY TEACHING HOURS	CREDITS
		4	5
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i>	Specialized general knowledge		
PREREQUISITE COURSES:	GEOLOGY FOR ENGINEERS (prerequisite course knowledge without the requirement of passing an exam)		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	eclass.uth.gr/courses/CULT_U_212/		

(2) LEARNING OUTCOMES

Learning outcomes <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i> <i>Consult Appendix A</i> • Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area • Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B • Guidelines for writing Learning Outcomes
1. Presentation of the basic principles and methods of Engineering Geology and Rock Mechanics. Description of the mechanical behavior of geological formations (intact rocks, rock masses) under loading conditions of geotechnical projects. 2. Analysis of the physical quantities and parameters involved in problems of Engineering Geology and Rock Mechanics. 3. Evaluation of the geological model and its effect on slopes, tunnels, dams, bridges. 4. Description of methods for dealing with geological natural disasters (landslides, earthquakes, etc.) and protection and improvement measures. Students: 5. Acquire the necessary scientific background in Engineering Geology and Rock Mechanics and learn to interpret, analyze and synthesize Engineering Geology and Rock Mechanics data to solve related problems in geotechnical studies and constructions, 6. Develop responsibility and professional ethics related to the responsibility of solving and addressing Engineering Geology and Rock Mechanics problems.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>
<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>
<i>Decision-making</i>	<i>Respect for the natural environment</i>
<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Team work</i>	<i>Criticism and self-criticism</i>
<i>Working in an international environment</i>	<i>Production of free, creative and inductive</i>
<i>thinking Working in an interdisciplinary environment</i>	<i>.....</i>
<i>Production of new research ideas</i>	<i>Others...</i>
	<i>.....</i>

Critical thinking skills in the analysis and synthesis of Engineering Geology and Rock Mechanics data and the evaluation of results. Working in an interdisciplinary environment. Adapting to new situations (each Engineering Geology and Rock Mechanics problem is unique). Developing professional and ethical responsibility during the construction of technical projects in the natural environment and in society. Bibliographic search and management of information and data using ICT. Developing individual responsibility, self-confidence and technical perception through the preparation of the semester project.

(3) SYLLABUS

1. Engineering Geology and Rock Mechanics in civil engineering works. Geological environment. Minerals and rocks. Discontinuities, intact rock, rock mass. Weathering. Analysis methods.
2. Stress theory, plane stress conditions, and equilibrium equations. Stress invariants, and deviatoric stresses. Strain theory, plane strain conditions and compatibility of strains. Strain gauges. Mohr circles.
3. Mechanical properties and mechanical behavior of rocks. Laboratory tests for the determination of the mechanical characteristics of rocks and rock masses. Constitutive equations. Hooke's law. Saint-Venant principle. Creep.
4. Rock and rock mass strength. The Hoek-Brown criterion. GSI index. Deformation modulus of rock mass. Classification systems for intact rocks and rock masses.
5. Geometrical concepts of planar and linear features in rock mass. Stereographic mapping of discontinuities. Statistical tectonics. Schmidt net. Geologic maps and geological sections.
6. Analytical solutions of classical elasticity problems in rock mechanics. Analysis of the thick-walled hollow cylinder. Circular hole a) in an infinite elastic medium and b) in an infinite elastic plate. Plastic deformation of a thick-walled hollow cylinder. Size / scale effects.
7. Fracture theories and failure criteria for intact rocks and rock masses. Effect of discontinuities. Coulomb theory, Mohr theory, Griffith theory. Limit equilibrium method. Pore pressure. In-situ stress state, geostatic stresses. Methods for measuring the in-situ stress field. Rock mass and groundwater. Permeability tests. Subsoil surveys - Drilling.
8. Aspects of discontinuum mechanics. Shear strength of discontinuities and rock masses. Laboratory and in-situ measurements. Nonlinear envelope of the maximum shear strength. Effect of scale. Infilled discontinuities. Methods and techniques to maintain and improve the mechanical properties of the rock mass. Shotcrete, grouting, anchoring, drainage.
9. Basic concepts of rock slope engineering. Stability of surface excavations. Safety factor. Plane and wedge failure. Toppling failure. Circular failure. Stabilization of rock slopes.
10. Engineering Geology of dams: Geotechnical construction problems and geological studies. Dam type selection. Stability of abutments, water tightness of reservoir and dam axis.
11. Engineering Geology of tunnels. Geotechnical parameters in tunneling and boring techniques. Stress state around underground excavations. A circular opening, a) in elastic rock and b) in stratified rock. Elastoplastic stress field around tunnels.
12. Stability studies, design methods and factors affecting the stability of tunnels. Failure criteria, support and reinforcement methods. Bridges: Engineering Geology in foundation elements.
13. Natural hazards. Landslides: Nomenclature and classification. Fundamentals of the landslides' investigation. Geological causes and factors of the occurrence of landslides. Protection and stabilization.

14. Special topics on Engineering Geology and Rock Mechanics. Repetitive exercises. Presentation of class project.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	In lectures, the lecturer uses a laptop PC and a projector. The lecturer communicates with the students and makes educational material available via eclass and email. In addition, the Department's website is used for course announcements. The students solve the relevant exercises during the lectures with the help of the lecturer. The semester project is posted via eclass. Bibliographic research by the students is done online via the university library website.	
TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i> <i>The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS</i>	Activity	Semester workload
	Lectures - Theory	28
	Exercises in the hall	28
	Home study	40
	Semester project	18
	Educational trip	8
	Exam preparation	15
	Examination	3
	Course total	140
STUDENT PERFORMANCE EVALUATION Description of the evaluation procedure <i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	The language of evaluation procedure is Greek. The final evaluation for grading takes place at the end of the semester and consists of two parts: 1) Written evaluation consisting of theory and exercises, and 2) Presentation of the semester project. The evaluation method and the grading criteria of the exam are made known to students in the 1st lesson and are announced in eclass.	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

In Greek:

- 1) Αγιουτάντης, Ζ.Γ., (2002), "Στοιχεία Γεωμηχανικής – Μηχανική Πετρωμάτων", Εκδόσεις ΙΩΝ.
- 2) Αντωνίου, Α. (2008), «Εφαρμογές Τεχνικής Γεωλογίας στην επιστήμη του Πολιτικού Μηχανικού» Σημειώσεις του μαθήματος, Πανεπιστημιακές Εκδόσεις Θεσσαλίας,
- 3) Εφραιμίδης, Γ. (2017), «Βραχομηχανική» Σημειώσεις του μαθήματος, Πανεπιστημιακές Εκδόσεις Θεσσαλίας.
- 4) Κούκης, Γ. και Σαμπατακάκης, Ν., (2007), "Γεωλογία Τεχνικών Έργων", Εκδόσεις: Παπασωτηρίου.
- 5) Μπαντής, Σ., (2008), "Τεχνική Γεωλογία", Εκδόσεις Gutenberg. [Διατίθεται στον ΕΥΔΟΞΟ].
- 6) Στουρνάρας, Γ. και Σταυροπούλου, Μ., (2018), "Τεχνική Γεωλογία", Εκδόσεις Τζιόλα.
- 7) Νομικός, Π., (2015), "Εισαγωγή στη Μηχανική Πετρωμάτων", Ηλεκτρονικό Βιβλίο, Σύλλογος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών, kallipos.

In English:

- 1) Brady, B.H.G., and, Brown, E.T., (1992), "Rock Mechanics for underground mining", Springer (Kluwer Academic Publishers Group).
- 2) Goodman, R.E., (1988), "Introduction to Rock Mechanics", John Wiley, New York.
- 3) Goodman, R. E., (1993), "Engineering Geology", John Wiley and Sons Ltd.
- 4) Hudson, J. A. and, Harrison, J. P., (2000), "Engineering Rock Mechanics: An Introduction to the Principles", Pergamon Press Inc (Elsevier Science & Technology).
- 5) Hudson, J. A. and, Harrison, J. P., (2001), "Engineering Rock Mechanics, Part 2: Illustrative Worked Examples", Pergamon Press Inc (Elsevier Science & Technology).
- 6) Jaeger, J. C., Cook, Neville G.W., and Zimmerman, R., (2007), "Fundamentals of Rock Mechanics", Wiley-Blackwell (Blackwell Science Ltd).
- 7) Wyllie D. C., and Mah C. W., (2004), "Rock Slope Engineering", Taylor & Francis.

- Related academic journals:

- 1) Acta Geotechnica, ISSN: 1861-1125
- 2) Computers and Geotechnics, ISSN: 0266-352X
- 3) Engineering Geology, ISSN: 0013-7952
- 4) Geomechanics for Energy and the Environment, ISSN: 2352-3808
- 5) International Journal of Rock Mechanics and Mining Sciences, ISSN: 1365-1609
- 6) Journal of Rock Mechanics and Geotechnical Engineering, ISSN: 1674-7755
- 7) Journal of the Mechanical Behavior of Materials, ISSN: 2191-0243
- 8) Rock Mechanics and Rock Engineering, ISSN: 0723-2632