

ECTS

ΕΥΡΩΠΑΪΚΟ ΣΥΣΤΗΜΑ ΜΕΤΑΦΟΡΑΣ ΑΚΑΔΗΜΑΪΚΩΝ ΜΟΝΑΔΩΝ  
ΣΤΗΝ ΕΥΡΩΠΑΪΚΗ ΕΝΩΣΗ

**(B) Course information in english**

**General course information:**

<b>Course title:</b>	Engineering Geology and Rock Mechanics	<b>Course code:</b>	ΓΕ0301
<b>Credits:</b>	5	<b>Work load (hours):</b>	140
<b>Course level:</b>	Undergraduate <input checked="" type="checkbox"/>	Graduate	<input type="checkbox"/>
<b>Course type:</b>	Mandatory <input type="checkbox"/>	Selective	<input checked="" type="checkbox"/>
<b>Course category:</b>	Basic <input type="checkbox"/>	Orientation	<input checked="" type="checkbox"/>
<b>Semester:</b>	8 <sup>th</sup>	<b>Hours per week:</b>	4
<b>Course objectives (capabilities pursued and learning results):</b>			
Introduction to engineering geology and rock mechanics: Basic concepts and applications. Engineering behaviour of geological formations (intact rocks, rock masses) under loading conditions in geotechnical works. Extended analysis of the physical quantities involved in rock mechanics problems. Estimation of the geological model and influence of the geological conditions in rock slopes, tunnels, and dams. Identification and means of mitigation – stabilization of geological hazards (rock slope instabilities, landslides). The course provides the essential scientific background, in the fields of engineering geology and rock mechanics, for civil engineers working on geotechnical studies and constructions.			
<b>Prerequisites:</b>			
<ul style="list-style-type: none"> <li>• Geology for Engineers</li> <li>• Solid Mechanics</li> </ul>			

**Instructor's data:**

<b>Name:</b>	Georgios Efraimidis
<b>Level:</b>	Assistant Professor
<b>Office:</b>	102A Civil Engineering Faculty University of Thessaly Pedion Areos, 383 34 Volos, Greece
<b>Tel. – email:</b>	+30-24210-74155, gefraim@uth.gr
<b>Other tutors:</b>	

**Specific course information:**

Week No.	Course contents	Hours	
		Course attendance	Preparation
1	Engineering geology and rock mechanics in civil engineering works. Geological environment. Minerals and rocks. Discontinuities, intact rock, rock mass. Weathering. Analysis methods.	4	2
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.	4	2

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	2
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.	4	2
5	Geometrical concepts of planar and linear features in rock mass. Stereographic mapping of discontinuities. Statistical tectonics. Schmidt net. Geologic maps and geological sections.	4	2
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.	4	2
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.	4	2
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.	4	3
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.	4	3
10	Engineering geology of dams: Geotechnical construction problems and geological studies. Dam type selection. Stability of abutments, water tightness of reservoir and dam axis.	4	3
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.	4	3
12	Stability studies, design methods and factors affecting the stability of tunnels. Failure criteria, support and reinforcement methods. Bridges: Engineering geology in foundation elements.	4	4
13	Natural hazards. Landslides: Nomenclature and classification. Fundamentals of the landslides' investigation. Geological causes and factors of the occurrence of landslides. Protection and stabilization.	4	4
14	Special topics on engineering geology and rock mechanics. Repetitive exercises. Presentation of class project.	4	6

<b>Additional hours for:</b>			
<b>Class project</b>	<b>Examinations</b>	<b>Preparation for examinations</b>	<b>Educational visit</b>
18	3	15	8

**Suggested literature:**In Greek:

- 1) Agioutantis, Z.G., (2002), "Geomechanics – Rock Mechanics", Ed. ION, Athens, Greece.
- 2) Antoniou A., (2008), "Applications of Engineering Geology to the Civil Engineering Constructions", Course notes, University of Thessaly Publications, Volos.
- 3) Bandis S., (2008), "Engineering Geology", Gutenberg, Athens.
- 4) Efremidis G. (2018), "Rock Mechanics", Course notes, University of Thessaly Publications, Volos.
- 5) Koukis, G. and Sabatakakis, N., (2007), "Geology of civil engineering works", Ed. Papatotiriou, Greece.

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 scientific 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

<b>Teaching method (select and describe if necessary - weight):</b>		
Teaching	<input checked="" type="checkbox"/>	50 %
Seminars	<input type="checkbox"/>	.....%
Demonstrations	<input type="checkbox"/>	.....%
Laboratory	<input type="checkbox"/>	.....%
Exercises	<input checked="" type="checkbox"/>	50 %
Visits at facilities	<input type="checkbox"/>	.....%
Other (describe): .....	<input type="checkbox"/>	.....%
<b>Total</b>		<b>100%</b>

<b>Evaluation method (select)- weight:</b>				
	<u>written</u>	<u>%</u>	<u>Oral</u>	<u>%</u>
Homework	<input type="checkbox"/>		<input type="checkbox"/>	
Class project	<input checked="" type="checkbox"/>	20	<input type="checkbox"/>	
Interim examination	<input type="checkbox"/>		<input type="checkbox"/>	
Final examinations	<input checked="" type="checkbox"/>	80	<input type="checkbox"/>	
Other (describe): .....	<input type="checkbox"/>		<input type="checkbox"/>	