8.3 CE0812 – Rock Mechanics - Tunnels

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0812**	**SEMESTER**	**8**
COURSE TITLE	**Rock Mechanics - Tunnels**		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	**4**	**5**

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization Course
PREREQUISITE COURSES:	Soil Mechanics (CE0540) Engineering Geology & Introduction in Rock Mechanics (CE0712) English level B2 or higher is required for Erasmus incoming students
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (English/Erasmus)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV167/

(2) LEARNING OUTCOMES

Learning outcomes

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.

Consult Appendix A

- *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*

The aim of the course is for the student to understand the mechanical behavior of the rock mass and the characteristics that affect its strength and deformability, to understand the principles governing the construction and operation of tunnels and accompanying works (e.g. orifices) and finally for the student to be able to apply simple dimensioning methods and to comprehend the geotechnical behavior of tunnels.

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

- To distinguish between the mechanical behavior of rocks from that of soils.
- To evaluate and apply methods for the classification of rocks and the rock mass in particular.
- To evaluate the mechanical properties of the rock mass
- To describe the phenomena that govern the construction and operation of underground technical works.
- To participate in study groups for the design and dimensioning of underground technical projects.
- To analyze the operation of existing underground projects at a preliminary level.

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?;.

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Search for, analysis and synthesis of data and information, with the use of the necessary technology*
Adapting to new situations	*Adapting to new situations*
Decision-making	*Decision-making*
Working independently	*Working independently*
Team work	*Team work*
Working in an international environment	*Working in an international environment*
Working in an interdisciplinary environment	*Working in an interdisciplinary environment*
Production of new research ideas	*Production of new research ideas*

The course aims that the student acquires - practice the following general skills:

- Search for, analysis of, and synthesis of data and information, implementing appropriate technologies
- Independent work - Team work - Working in an international / interdisciplinary environment
- Decision-taking
- Proact free, creative and inductive thinking
- Project planning and management

(3) SYLLABUS

Rock mechanics: evolution and applications. Intact rock and rock mass. Discontinuities and their influence on rock mass behavior. Classification systems. In-situ stress distribution. Physical characteristics, mechanical behavior, and intact rock and rock mass failure criteria.
Tunnels: Stress distribution and deformation in deep and shallow tunnels under elastic and elastoplastic loading. Relaxation mechanism of the rock mass: convergence-deconvolution curves. Principles of the NATM method, temporary support and interaction with the rock mass. Tunnel Boring Machines (TBM). Design of final lining in tunneling

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of I.C.T. in Teaching and Student Communication
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop,*	

Activity	***Semester workload***
In Class (/Distance) Teaching	52
Literature Study	35

interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *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*		Exercises / Paradigms	32
		Project assignment / Essay	31
		Course total	**150**
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek (English/Erasmus) Written examination, 2,5-hours Problem solving, Multiple choice test, Questions and Answers, Written Essay / Project The evaluation criteria are announced to the students well before the examination; weights per subject /exercise are explicitly indicated. The examination results (including total / partial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc.		

(5) **ATTACHED BIBLIOGRAPHY**

Greek Bibliography:

1. Μαραγκός Χ.Ν. Τεχνικά Έργα Υποδομής, Κατασκευές στην επιφάνεια βράχου, Υπόγειες κατασκευές, Βραχομηχανική, Φράγματα, 2003.
2. Αγιουτάντης Ζ. Στοιχεία γεωμηχανικής. Στέλλα Παρίκου και Σία ΟΕ.,2002.

Foreign Bibliography:

1. Goodman R.E. Introduction to Rock Mechanics
2. Goodman R., Shi G-H. "The Block Theory and its Application to Rock Engineering"
3. Mogi K. Experimental Rock Mechanics
4. Hoek E. Practical Rock Engineering
5. Hoek E., Bray J. Rock Slope Engineering
6. Hoek E., Brown ET. Underground Excavations in Rock Hoek E., Kaiser PK., Bawden WF. "Support of Underground Excavations in Hard Rock"
7. Eberhardt E. Rock Engineering, Practice and Design
8. Bieniawski Z. Engineering rock mass classifications
9. Bieniawski Z. Rock Mechanics Design in Mining and Tunnelling
10. Brady B., Brown E. Rock mechanics for underground mining
11. Thiel K. Rock mechanics in hydroengineering