7.3 CE0712 – Engineering Geology & Introduction to Rock Mechanics

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0712**	**SEMESTER**	**7**
COURSE TITLE	**Engineering Geology & Introduction to Rock Mechanics**		

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**
	3	4
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization Course
PREREQUISITE COURSES:	Geology for Engineers (CE0140) English level B2 or higher is required for Erasmus incoming students
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV199/

(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 to provide the student with the required knowledge in order to understand and evaluate the geological features and structures that affect the mechanical behavior of rocks and to introduce him/her to the basic principles and methods of describing the mechanical behavior of rocks and the rock mass.

Upon successful completion of the course the student will:

- Be able to identify and evaluate the geological structures that affect the behavior and design of an engineering project.
- Be able to apply the stereographic projection methods to evaluate potential kinematically acceptable failure mechanisms.
- Be able to assess the geological model and its effect on slopes, tunnels and dams and draw geological cross-sections.
- Be familiar with protection methods against geological hazards (rocky slope instabilities, landslides)
- Be able to calculate and evaluate the mechanical properties of intact rock.
- Be able to calculate and evaluate the mechanical properties of rock mass

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
- Decision-taking
- Project planning and management
- Proact free, creative and inductive thinking

(3) SYLLABUS

Theory

1. Introduction. Transition from Technical Geology to Engineering Geology. Methods and types of retaining structures. Gravity walls, cantilever walls, counterfort walls, reinforced earth walls, and examples.
2. Petrology. Geological environment. Minerals and rocks. Technical and geological characteristics. Interaction of petrographic and physical characteristics with geotechnical projects. Effects on the design and the response of geotechnical works.
3. Geological structures, discontinuities, intact rock, rock mass. Weathering. Interaction with geotechnical projects. Effects on the design and the response of geotechnical works.
4. Hydrogeology. Groundwater. Hydrological cycle. Rivers. Groundwater aquifers.
5. Applications of engineering geology. Dams. Geological engineering issues during construction and geological studies. Dam type selection. Stability of abutments, reservoir watertightness and dam location.
6. Applications of engineering geology. Landslides. Rotational slides. Protection and stabilization measures in rocky slopes.
7. Applications of engineering geology. Bridges. Selection of type and form of bridge foundations.
8. Description and mechanical properties of intact rock. Point load strength. Uniaxial compressive strength. Modulus of elasticity. Hoek - Brown failure criterion. Estimation of Mohr - Coulomb failure criterion parameters.
9. Description and mechanical properties of rock masses. Discontinuity strength, Paton and Barton criteria. RMR, Q and GSI classification systems.
10. Stereographic projection. Application to the identification and evaluation of kinematically acceptable mechanisms. Plane failure. Wedge failure.

Practicals

1. Assignment: Dam - sections and embankment. Excavations requirements for the entrance and exit points of the drainage and diversion tunnels. Design of cross-sections and horizontal section.
2. Stereographic projection.
3. Calculation of anchored wall and programming in a spreadsheet.
4. Calculation of counterfort wall and programming in a spreadsheet.
5. Calculation and design of anchors and bolts

(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, 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*	

Activity	***Semester workload***
In Class (/Distance) Teaching	39
Literature Study	30
Exercises / Paradigms	30
Project assignmenet / Essay	21
Course total	**120**

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. The examination is in Greek for resident students. Erasmus students are examined in English.

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Stournaras G., Stavropoulou M. Engineering Geology, Publications A. Tziolas & Yios S.A., 2010
2. Koukis George H.,Sabatakakis Nikolaos S. Engineering Geology, 2nd edition, Publications A. PAPASOTIRIOU & SIA I.K.E., 2019 (in Greek).
3. Dimopoulos Georgios Engineering Geology, Publications P.A.S.A. PAPASIKOS & S.A. KYRIAKIDI, 2008 (in Greek).

4. Mpantis Stavros K., Engineering Geology, C. G. G. DARDANOS - K. DARDANOS LTD., 2008 (in Greek).

Foreign Bibliography:

1. Goodman, R. E., Introduction to Rock Mechanics, Wiley, 1989
2. Blyth, F.G.H. & de Freitas, Michael , A Geology for Engineers, Seventh Edition, Taylor & Francis, 1984