COURSE OUTLINE

(1) GENERAL

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΓΕ0801**	**SEMESTER**	8ο
COURSE TITLE	GEOTECHNICAL EARTH STRUCTURES		

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).		

COURSE TYPE *general background, special background, specialized general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	-

(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*

Students study the analysis and design of embankments, earth dams, and rockfill dams. They explore the geological environment, foundation issues, and construction materials. Slope stability analyses and subsurface flow networks are conducted. Filters, diaphragms, and grouting are examined. Quality control of embankment zones is performed. Methods for analyzing the seismic behavior of dams using performance criteria are studied. Extensive historical cases of good and poor performance are investigated. Visits to actual dam sites with technical presentations are organized.

Upon completion of the course, students are able to:

1. Design the basic components of a dam.
2. Analyze slope stability.
3. Analyze subsurface flow networks.
4. Design filters, diaphragms, and grouting.
5. Perform quality control of embankment zones.
6. Analyze the seismic response of dams in a performance-based approach

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking Working in an interdisciplinary environment*
Production of new research ideas	*……*
	Others…
	…….

The students acquire the following general competences:

1. Analysis and synthesis of data
2. Decision making
3. Project planning and management

(3) SYLLABUS

Introduction. Embankments, earth dams and rockfill dams. Selection of dam type and zoning. Frequent causes of failure. Geologic conditions, foundation problems, construction materials. Special geotechnical problems associated with common geologic formations. Geotechnical site investigation. Permeability tests. Laboratory investigation of foundation and construction materials. Geotechnical parameters. Methods of slope stability analysis of embankments and dams. Applications of slope stability of embankments and natural slopes. Seepage flow through the foundation and embankment. Liquefaction. Pore water pressures within the embankment. Design and construction of filters. Special problems in clayey soils, piping erosion. Specifications and quality control in the embankment zones, Proctor's tests. Preparation of foundation, excavation at the abutments and associated problems. Diaphragms and cement grouting. Construction details of embankments. Stages of construction and related works (diversion tunnel, spillway, etc). Concrete-faced rockfill dams. Comparative advantages. Investigation of case histories of the performance of such dams. Site visit of an actual dam. Analysis of the specific geologic conditions, foundation conditions, used materials, and other topics of design and safety. Seismic analysis of dams. Methods of analysis. Permanent seismic displacements of slopes. Examples of numerical simulations of actual dams. Issues on dam safety. Monitoring the performance of dams with instruments.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY ***Face-to-face, Distance learning, etc.***	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT in teaching, communication with students

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*
Lectures	52
Study, solving of sets of problems and preparation of semester project	50
Preparation for examinations	12
Examinations	3
Educational visit to a dam	5
Course total	*122*

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.*	The evaluation is conducted through written exams at the end of the semester in Greek, with a weighting of 70%, and through the semester project and exercises, which carry a weighting of 30%. The exams are based on solving a series of problems that cover all the fundamental topics of the course and require a thorough understanding of the theory and extensive preparation through the completion of exercise booklets during the semester.

(5) **ATTACHED BIBLIOGRAPHY**

-Suggested bibliography:

1. Geotechnical Earth Structures, Thanopoulos, I., 2012 (in Greek, distributed)
2. Geotechnical Engineering of Dams, Robin Fell, Patrick MacGregor, David Stapledon, Graeme Bell, Taylor & Francis, 2014.
3. Concrete Face Rockfill Dams, Paulo Teixeira da Cruz, Bayardo Materon, Manoel De Souza Freitas Jr., CRC Press, 2015
4. Geotechnical engineering of embankment dams, R.Fell, P.MacGregor, D.Stapledon, A.A. Balkema Publishers, 1992.
5. Design of small dams, U.S Dep. of the Interior, A Water Resources, Technical Publication, 3rd Edition, 1987.
6. Instrumentation of embankment dams and levees, U.S. Army Corps of, Eng., Eng. Manual 1110-2-1908, 1995.
7. Design and construction of levees, U.S. Army Corps of Eng., Eng. Manual, 1110-2-1913, 2000.
8. Stability of earth and rock-fill dams, U.S. Army Corps of Eng., Eng., Manual 1110-2-1902, 1970.
9. Construction control for earth and rock-fill dams, U.S. Army Corps of Eng., Eng. Manual 1110-2-1911, 1995.

- Related academic journals:

1. Géotechnique
2. Soil Dynamics and Earthquake Engineering