COURSE OUTLINE

(1) GENERAL

SCHOOL	**UNIVERSITY OF THESSALY**		
ACADEMIC UNIT	DEPARTMENT OF CIVIL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΓΕ0500**	**SEMESTER**	9ο
COURSE TITLE	GEOENVIRONMENTAL ENGINEERING		

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	6
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:	Soil Mechanics I, Environmental Engineering
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*

Upon completion of the course, students:

1. Recognize and are able to address geo-environmental issues caused by natural processes and/or human activities.
2. Identify and are able to assess the forms, extent, and risks of environmental impacts due to soil instability, erosion, contamination, etc.
3. Are capable of applying modern geotechnologies for predicting, avoiding, and managing risks related to the geo-environment, as well as for strengthening and improving soil as a foundation medium for engineering works.
4. Possess the necessary background to investigate and evaluate the physical, chemical, and mechanical properties of the geo-environment (soil materials and additives) through laboratory and field tests.
5. Understand the basic principles of conducting environmental impact studies related to infrastructure construction, waste storage, natural resource exploitation, and more.
6. Develop a sense of responsibility and professional ethics concerning the preparation of accurate environmental geotechnical studies and the understanding of the Civil Engineer's role in protecting the environment.

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…
	…….

Bibliographic research and information management using ICT.
Familiarization with the application of geotechnical design methods for engineering projects.
Development of critical thinking skills in selecting data and evaluating the results of problems.

(3) **SYLLABUS**

Purpose and objectives of the course. Program and course content. Protection of geo-environment. Forms and causes of pollution. Pollution and rehabilitation of geoenvironment in Greece and abroad. Institutional framework and case law on environmental protection. Environmental impact assessment. Legislative status of environmental protection in Greece today and in the past, in Europe and America. Soil and hydrogeology data. Minerals - rocks. Categories of soils. Movement of groundwater into soils. Estimation of hydraulic parameters of aquifers. Exploitation of aquifers by pumping. The role of plants and vegetation in civil engineering works. Hydrological and mechanical mechanisms of protection and stabilization of slopes in the presence of vegetation. The role of vegetation as a measure of protection against erosion. Territorial erosion. Types of corrosion and factors that cause it. Classification of corrosion. Consequences. Hydraulic corrosion. Surface erosion. Internal corrosion. Principles and measures to protect soil from erosion. Soil pollution. Pollutant characteristics. Sources and acceptable limits of pollution. Polluted and contaminated soils. Related terms. Interaction of soil with soil. The phases of soil and pollutants and the balance between them. Pollution, evolution mechanisms and simulation of pollutant transport. Geotechnical research and control techniques in contaminated sites and disposal sites. Methods and techniques for restoration of contaminated soils. Categories of solid waste. Municipal waste. Management techniques. Solid waste disposal. Sorting in Source. Collection Centers of recyclable materials - Mechanical Recycling. Thermal processing methods. Biological processing methods. Engineering and Biological Processing Units. Landfill. Institutional framework. Compost making from home disposals. Aesthetics of technical works. Design and study of technical projects taking into account the factor of aesthetics. Impact. Examples. Geotechnical research. Purpose. Institutional framework. Methods of geotechnical research. Sample boreholes and excavations. In-field field trials. Laboratory tests. Classification and soil resistance tests. The triaxial test. Modern methods of determining basic physical and mechanical properties of soils. Permeability tests, chemical identification tests and rheological properties of fluids and viscosity measurement tests Soil filters: role, importance and design. Improvement and reinforcement of soils. Preload, condensation, dynamic condensation, vibratory condensation, vibratory replacement, reinforcement, reinforcing with injections, thermal action. Recent methods of improvement: passive stabilization, stabilization with bio-materials (bacteria), artificial cementing.

(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 theory	56
Lectures exercises	22
Exercises at home	20
Study at home	30
Preparation for examinations	25
Examinations	3
Laboratory test	4
Course total	*160*

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 language is Greek. The final assessment for grading is done at the end of the semester. It is written and consists of theory questions with short answers and problem-solving exercises that cover the entire taught material. In addition to the final exam, there is the option to participate in an optional progress test (written exam during the semester), as well as in two individual assignments and one group assignment, which provide feedback and shape the educational process. The evaluation method and grading criteria for the course (final exam, progress test, and assignments) are communicated to the students in the first class and are announced on eclass.

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

1. Kavvadas, M., Pantazidou, M. (2013) Geoenvironmental Engineering, NTUA Ed., (in Greek).
2. Sharma, H.D. & Reddy, K.R., 2004. Geoenvironmental Engineering: site remediation, waste containment and emerging waste management technologies, Wiley.
3. Sarsby, R.W., 2000. Enviromental Geotechnics, Thomas Telford edt.
4. Reddi, L. & Inyang, H.I., 2000. Geoenvironmental Engineering: Principles and applications, Marcel Pecker inc.
5. Mohamed, A.M.O. & Paleologos E.K., 2017. Fundamentals of Geoenvironmental Engineering: Understanding Soil, Water, and Pollutant Interaction and Transport, Butterworth-Heinemann ed.
6. LaGrega, M., Buckingham P.L. & Evans, J.C., 2001. Hazardous Waste Management, Mc Graw Hill. Freeze, R.A. & Cherry, J.A., 1979. Groundwater, Prentice Hall
7. Fetter, C.W., 1999. Contaminant Hydrogeology, MacMillan Mitchell, J.L. 1993. Fundamentals of Soil Behaviour, Willey

8. Quian, X., Koerner, R.M. & Gray, D.H., 2002. Geotechnical Aspects of Landfill Design and Construction, Prentice Hall

- Related academic journals:

1. Journal of Geotechnical and Geoenvironmental Engineering, ASCE
2. Environmental Geotechnics, ICE
3. Environmental Engineering, ASCE
4. Environmental Engineering and Science
5. Géotechnique
6. Geotechnical and Geological Engineering
7. International Journal of Geotechnical Engineering
8. Canadian Geotechnical Engineering
9. Soils and Foundations Geotechnical Engineering, ICE