7.8 CE0722 – Environmental Geotechnics

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0722**	**SEMESTER**	**7**
COURSE TITLE	**Environmental Geotechnics**		

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, specialised general knowledge, skills development*	Special Background Course
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes, in English language.
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV163/

(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 aims of this course are:

- To acquaint students with the fundamental principles and multidisciplinary approaches used in Environmental Geotechnics.
- To study and understand basics in legislation related to contamination, screening values and environmental criteria.
- To understand geotechnical aspects of waste and waste disposal sites.
- To study the soil properties, contaminants and contaminant transport processes in the subsurface.
- To understand soil-water-environment interaction and soil-contaminant interaction
- To be familiar with one dimensional steady-state flow in saturated soil and equations for multi-phase fluid flow in porous media.

- To understand the fundamentals of contamination and pollution.
- To be able to discriminate natural from anthropogenic pollution sources.
- To be familiar with procedures of soil, sediment and water sampling.
- To delineate contaminated land. To acquaint students with basic principles of hydrogeology and environmental geochemistry. To understand geochemical processes and human health risk.
- To understand contaminants distribution in groundwater and soil solids.
- To understand contaminant transport and fate of contaminants.
- To understand dispersion of pollutants, phenomena of advection, diffusion, mechanical dispersion, sorption and pollutant decay.
- To understand protection of the subsurface (soil and groundwater) from potential pollutants.
- To understand soil remediation. Remediation technologies, soil washing, soil vapor extraction etc.
- To understand aspects related to landfills, leachate generation, landfill liners, materials used in compacted and geosynthetic clay liners.

Upon completion of this course, students will have:

1. Basic knowledge of environmental geotechnics.
2. Knowledge and understanding of fate and transport of contaminants and geochemical processes.
3. In-depth knowledge and critical understanding.

Specifically, students will be able to:

1. Have adequate comprehension skills of understanding fate and transport of contaminants and remediation goals.
2. Evaluate the contaminated land and groundwater contamination.
3. Manage time in an appropriate manner.

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…*

Specifically, students will be able to perform:

- Working in an interdisciplinary environment
- Working in an international environment
- Search, analysis and synthesis of data and information, using the necessary technologies.
- Respect for the natural environment
- Production of free, creative and inductive thinking
- Decision-making
- Team work
- Autonomous work

(3) SYLLABUS

1. Basic introduction. Fundamental concepts of Environmental Geotechnics.
2. Introduction to legislation related to contamination, screening values and environmental criteria.
3. Geotechnical aspects of waste and waste disposal sites.
4. Nature of soils, contaminants and contaminant transport processes in the subsurface.
5. Soil-Water-Environment interaction
6. Soil-contaminant interaction

7. One dimensional steady-state flow in saturated soil.
8. Equations for multi-phase fluid flow in porous media.
9. Contamination and Pollution. Discriminate natural from anthropogenic pollution sources.
10. Soil, sediment and water sampling. Delineating contaminated land. Basic principles of hydrogeology and environmental geochemistry. Geochemical processes. Human health risk.
11. Contaminants distribution in groundwater and soil solids. Contaminant transport and fate of contaminants, case studies
12. Pollution spreading, phenomena of advection, diffusion, mechanical dispersion, sorption and pollutant decay.
13. Protection of the subsurface (soil and groundwater) from potential pollutants.
14. Soil remediation. Remediation technologies, soil washing, soil vapor extraction.
15. Landfills, leachate generation, landfill liners, materials used in compacted and geosynthetic clay liners.

(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*	Teaching using ICT, Communication and Electronic Submission.
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*	
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 (in English for Erasmus students) Final written examination: 80% Preparation for the project: 20% or Final written examination: 100%

Activity	***Semester workload***
Lectures	39
Personal Study	41
Preparation for Project	40
Course total	**120**

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Kavvadas M. (2013) Principles of Environmental Geotechnics. Tsiotras Publications. Athens. (in Greek)
2. Kugolos A. (2021) Environmental Engineering. 3rd Edition, Tziolas & Sons Publications. Thessaloniki. (in Greek)
3. Schnoor J. (2017) Environmental Models. Fate and Transport of Contaminants in Air, Water and Soil. 2nd Edition. Tziolas Publications. (in Greek)

Foreign Bibliography:

1. Sarsby R. (2013) Environmental Geotechnics, 2nd edition. Ice publishing.
2. Appelo C., Postma D. (2005) Geochemistry, groundwater and pollution. A.A. Balkema Publishers, Leiden.

3. Berkowitz B., Dror I., Yaron B. (2008) Contaminant Geochemistry. Interactions and Transport in the Subsurface Environment. Springer-Verlag Berlin Heidelberg.
4. Alexakis D. (2011) Diagnosis of stream sediment quality and assessment of toxic element contamination sources in East Attica, Greece. Environmental Earth Sciences, 63: 1369-1383, DOI: 10.1007/s12665-010-0807-9
5. Alexakis D. (2011) Assessment of water quality in the Messolonghi-Etoliko and Neochorio region (West Greece) using hydrochemical and statistical analysis methods. Environmental Monitoring and Assessment, 182:397-413, DOI: 10.1007/s10661-011-1884-2
6. Gamvroula D., Alexakis D., Stamatis G. (2013) Diagnosis of groundwater quality and assessment of contamination sources in the Megara basin (Attica, Greece) Arabian Journal of Geosciences, 6 (7):2367-2381, DOI: 10.1007/s12517-012-0533-6
7. Alexakis, D., Gamvroula, D. (2014) Arsenic, chromium, and other potentially toxic elements in the rocks and sediments of Oropos-Kalamos basin, Attica, Greece. Applied and Environmental Soil Science, Volume 2014, Article number 718534
8. Alexakis D. (2016) Human health risk assessment associated with Co, Cr, Mn, Ni and V contents in agricultural soils from a Mediterranean site, Archives of Agronomy and Soil Science, 62 (3):359-373, DOI: 10.1080/03650340.2015.1062088
9. Alexakis D., Gamvroula D., Theofili E. (2019) Environmental availability of potentially toxic elements in an agricultural Mediterranean site. Environmental and Engineering Geoscience, 25(2):169-178 DOI: 10.2113/EEG-2129
10. Alexakis D., Kokmotos I., Gamvroula D., Varelidis G. (2020) Wildfire effects on soil quality. Application on a suburban area of West Attica (Greece). Geosciences Journal (https://www.springer.com/journal/12303), DOI: 10.1007/s12303-020-0011-1
11. Alexakis, D. (2020), Suburban areas in flames: Dispersion of potentially toxic elements from burned vegetation and buildings. Estimation of the associated ecological and human health risk. Environmental Research, 183, 109153, DOI:10.1016/j.envres.2020.109153.
12. Alexakis D. (2020) Meta-Evaluation of Water Quality Indices. Application into Groundwater Resources. Water 2020, 12(7), 1890, DOI:10.3390/w12071890 (registering DOI) - 02 Jul 2020

Related academic journals:

1. Environmental Earth Sciences (Springer)
2. Environmental Geotechnics (ice publishing)
3. Applied Water Science (Springer)
4. Earth Sciences Research Journal (Universidad NACIONAL de Colombia)
5. Environmental Engineering and Management Journal ("Gheorghe Asachi" Technical University of Iasi, Romania)
6. Environment, Development and Sustainability (Springer)
7. Environmental Geochemistry and Health (Springer)
8. Environmental Modeling and Assessment (Springer)
9. Environmental Monitoring and Assessment (Springer)
10. Water-Air & Soil Pollution (Springer)
11. International Journal of Global Environmental Issues (Inderscience)
12. Archives of Agronomy and Soil Science (Taylor and Francis Ltd)
13. Toxicological & Environmental Chemistry (Taylor and Francis Ltd)
14. Environmental and Engineering Geoscience (Geological Society of America)
15. Environmental Research (Elsevier)
16. Geosciences Journal (The Petrological Society of Korea and Korea Geophysical Society. Geosciences Journal is co-published with Springer from 2008)