COURSE OUTLINE

1. GENERAL

SCHOOL	School of Environment and Agricultural Engineering		
ACADEMIC UNIT	Development of Natural Resources and Agricultural Engineering		
LEVEL OF STUDIES	Postgraduate (MSc)		
COURSE CODE	630017	**SEMESTER**	**1st**
COURSE TITLE	Environmental Geology – Geochemistry		

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**
Lectures and laboratory exercises	3	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*	Specialised general knowledge
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (In English)
COURSE WEBSITE (URL)	**https://oeclass.aua.gr/eclass/modules/course_info/?course=2731**

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 course emphasizes the basic concepts of general geochemistry with the ultimate goal of answering questions related to environmental geochemistry.

In particular, the general principles of geochemistry, aqueous and non-aqueous, systems, the processes that govern geochemical processes and the connection with the environment (in general) and urban geochemistry (in particular) are presented. The student will be able to understand the main chemical components of the natural environment, their creation and evolution in our solar system. The aim of the course is to understand the concept of environmental geochemistry through the chemical processes that take place between the lithosphere, hydrosphere, atmosphere and biosphere.
Finally, students will be able to respond to applications or research needs during their professional careers or during post-graduate studies (e.g. PhD studies).
Upon successful completion of the course, the student will be able to:

- understood the origin of chemical elements by linking them to the early stages of the formation of our solar system
- understood the structural components of natural environments (e.g., clay minerals).

- taught the main principles of cosmochemistry and chemical reactions.
- Can apply the principles to help understand how physical processes affect the chemical element content of soils.
- understand the role of the environment in human health.
- Analyze and develop geochemical simulation models of natural systems through the evaluation of environmental geochemistry data.
- Synthesize the results, to evaluate them, and to present a paper that will include the basic structure of a thesis (Abstract - Introduction - Material and Methodology - Results - Discussion - Conclusions - References).

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…*
	…….

- Autonomous Work
- Search, analysis and synthesis of data and information, using the necessary technologies
- Generating new research ideas
- Respect for the natural environment
- Promotion of free, creative and inductive thinking

3. SYLLABUS

1. INTRODUCTION – Course description and objectives – Geochemistry and environment
2. COSMOCHEMISTRY – The origin of the elements – Chemical elements in our solar system – Solar spectrum
3. ISOTOPES – Stable/Radioactive – Meteorites – Origin
4. REACTIONS – Oxidation reduction – Carbonic balance – Chemical decomposition
5. CLAY MINERALS – Absorption CO_2 capture-storage technologies
7. ENVIRONMENTAL GEOCHEMISTRY AND HEALTH •Relationship and effect of concentrations of chemical elements on terrestrial media and human health •Methodology of risk assessment studies
8. TRACE ELEMENTS IN SOIL• Natural and anthropogenic sources • Mobility - Environmental availability • Case studies on agricultural soils from the Argos-Nemea regions
9. N- P CYCLES • Processes • Anthropogenic interventions • Environmental impacts
10. URBAN GEOCHEMISTRY • Definition of urban geochemistry • Characteristics of urban soil • Dispersion of trace elements in the urban environment • Investigations in Athens
11. PROCESSING- EVALUATION OF ENVIRONMENTAL GEOCHEMISTRY DATA • Uncertainty assessment of geochemical survey measurements • Statistical analysis methods • Geochemical reports of results
12. GEOCHEMICAL MAPPING • Illustration of data on geochemical maps •Spatial analysis of geochemical data •Practice using PC

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In the class. Teaching with active participation of the students through questions and answers and their participation in the presentation of specific concepts-topics in order to stimulate them in Geochemistry subjects.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	1. Specialized free software for geochemical simulations Alphamelts, PHREEQC. 2. Learning process support through the e-class electronic platform.
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.*	I. Writing final exam (70%) consisting of: - short-answer questions (opened/closed at a ratio 60:40) - Problem solving - Searching for mistake-replacement by correct answer on a text - Matching theory elements II. Written work (15%) – Based on the evaluation/identification of minerals from real geochemical data III. Presentation (15%)

Activity	***Semester workload***
Lectures	36
Laboratory practice focusing on methodologies and analysis of case studies	24
Study and analysis of bibliography	20
Short practical essays	10
Essay writing	25
Presentation	10
Course total	***125***

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

White, W. M. (2020). Geochemistry. John Wiley & Sons.
Kula Misra. INTRODUCTION TO GEOCHEMISTY: PRINCIPLES AND APPLICATIONS (translation: Ariadne Argyraki).

- Related academic journals:

Earth and Planetary Science Letters, Geochemistry Geophysics Geosystems, Environmental Geochemistry, Elements, Environmental Geochemistry and Health, Environmental Pollution, Environmental Pollution Series B Chemical and Physical.