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	630026	**SEMESTER**	**2nd**
COURSE TITLE	Advanced analytical techniques of rocks and geomaterials		

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/courses/3523/

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 represents a basic tool introducing the concepts of analytical techniques of rocks, minerals and geomaterials.

In particular, the techniques of studying minerals (as components of rocks) and geomaterials at the micro -scale are presented. The students will acquire knowledge of advanced analytical techniques, complemented with their basic knowledge of mineralogy and petrology. The combination of previous knowledge will enable students to comprehend issues related to the study of each mineral, rock or geomaterial on different observation scale. Additionally, it will impart new knowledge guiding them in the application of this knowledge based on its relevance.

The ultimate goal is for the students to gain an understanding of the analytical techniques used in the laboratories in Greece and abroad, in the industry, and how they can analyze, synthesize, and evaluate the analytical data resulting from each technique. The course aims at analytical techniques, through the use of which, the student will be able to understand the structure and chemistry of minerals and other geomaterials (e.g. ice). Hands-on practice with analytical instruments and software will be an important part of the course. Students should be able to respond to applications or research needs during their professional career or during their doctoral studies.

Finally, upon successful completion of the course, the student will be able to collaborate with fellow students to create a small project and present an independent project that includes the basic structure of a degree study (Summary - 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
- Criticism
- Respect for the natural environment
- Promotion of free, creative and inductive thinking

3. SYLLABUS

1. INTRODUCTION – Course description and objectives – General about minerals-rocks-geomaterials
2. Methods of studying inorganic materials
3. Determination of material texture-Optical microscopy-I
4. Determination of material texture-Optical microscopy-II
5. Determination of material structure – Diffraction X- rays
6. Diffraction -X- rays – evaluation of prepared radiographs – crystal sample analysis – use of Diffracplus
7. Microscale determination of mineral chemistry – analytical errors – use of standard samples – calibration – chemical element distribution maps scanning electron microscope – electronic microanalyzer
8. Determination of chemical formula – use of PC and cation distribution determination programs
9. Method of analysis using an electron probe microanalyzer
10. XMapTool usage
11. Infrared Spectroscopy – Fityk Program – Spectrum Analysis
12. Raman Spectroscopy – Fityk Program – CrystalSleuth Program - Spectrum Analysis

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In the class. Teaching with active participation of the students through question-and-answer and their participation in the presentation of specific concepts-topics with the aim of stimulating them in the topics of methods of analysis of minerals, rocks and geomaterials.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	1. Specialized free distribution software for evaluation of X-ray diagrams and Raman spectra. 2. Learning process support through the e-class electronic platform (in- class chat with questions/comments displayed in live time during the lecture).
TEACHING METHODS	***Activity*** | ***Semester workload***

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*	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***

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. Written final exam (50%) which includes: - Short answer questions (closed type) - Problem solving - Error detection-replace from correct to text - Matching theory elements II. Written assignment (30%) – It will be based on mineral evaluation/identification based on real geochemical data III. Work presentation (20%)

5. ATTACHED BIBLIOGRAPHY

-Suggested Bibliography:

Reed, SJB (2005). Electron microprobe analysis and scanning electron microscopy in geology. Cambridge university press.

Waseda , Y., Matsubara, E., & Shinoda, K. (2011). X-ray diffraction crystallography: introduction, examples and solved problems. Springer Science & Business Media.

Smith, E., & Dent, G. (2019). Modern Raman spectroscopy: a practical approach. John Wiley & Sons.

- Relevant scientific magazines:

Journal of Raman Spectroscopy, MAPS, American Mineralogist, Icarus, Developments in clay science, Applied Clay Science, Reviews in Mineralogy, Scientific Reports