COURSE OUTLINE

1. GENERAL

SCHOOL	ENVIRONMENT AND AGRICULTURAL ENGINEERING		
ACADEMIC UNIT	NATURAL RESOURCES AND AGRICULTURAL ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**630027**	**SEMESTER**	**2st**
COURSE TITLE	ACTIVE TECTONICS AND SEISMIC HAZARD ASSESSMENT		

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	3	3
Essays		2
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	3	5

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek - English
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*

Greece is experiencing several different types of natural hazards, but the predominant one is seismic hazard. It is well-known that almost 40% of the total seismic energy released in Europe originates from Greece. Active faults are the seismic sources; therefore their characteristics (geometry, kinematics, deformation rates) define the hazard pattern, affecting both the prevention planning and the mitigation measures. Earthquakes can cause major social unrest and economic costs, therefore the insurance and reinsurance industry are highly involved through the application of earthquake catastrophe models.

Students will comprehend how the landscape is formed by successive earthquakes (Seismic landscape and Tectonic geomorphology) and will study several geomorphological indices that provide key info on the extraction of fault slip-rates. Thus, this course will provide key info regarding the impact of fault activity on the landscape, the geological structure and the building environment. Students will be introduced to several cutting-edge methodologies for extracting slip-rates such as paleoseismic trenching, geodesy (GPS, In-SAR, GNSS), cosmogenic isotope dating of fault scarps, marine terraces and marine notches. In addition, students will learn how faults grow, how they interact with other faults, what are their fractals dimensions, how their slip-rates define their recurrence and finally how we can construct seismic hazard maps from geological-fault slip-rate data. Overall, students are expected to assess how active faults define seismic hazards and are expected to be familiar with the deterministic and probabilistic seismic hazard assessment and with their differences. In addition, they will learn how poissonian and time dependent conditional probabilities are extracted and how they relate to the seismic cycle. Lectures will be focused also on the seismic shacking, seismic intensity and peak ground acceleration. In this perspective, students will learn how earthquake environmental effects have now been quantified and described under the Environmental Seismic Intensity

ESI2007. Students will be able to assess the damage pattern from the activation of major faults and how this is useful for prevention planning. Finally, they will be introduced to Earthquake catastrophe modelling for insurance processes, showing the example the fault specific earthquake risk Catastrophe model developed for the Attica region.

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…*
	…….

Respect for the natural environment
Working in an interdisciplinary environment
Decision-making
Project planning and management
Search for, analysis and synthesis of data and information, with the use of the necessary technology
Working independently

3. SYLLABUS

Earthquakes and Faults, Earthquake Focal mechanisms, Active fault mapping, Geomorphological indices and Tectonic Geomorphology, Fractals- Faults- Seismicity pattern, Seismicity rates, GR distribution and characteristic earthquake model, Fault interaction processes, stress transfer and stress triggering, Faults growth mechanism, Deformation rates- Slip-rates and earthquake recurrence, methods of extracting rates, Geological data and seismic hazard assessment, seismic cycle, paleoseismology and earthquake geology, Deterministic – Probabilistic and Fault specific seismic hazard maps, Poissonian, time dependent and Conditional probabilities, Geological formations – foundation factor and seismic shaking (intensity and Peak Ground acceleration), Mercalli intensity, Environmental Seismic Intensity ESI 2007, Large infrastructure works and seismic design- several examples, Earthquake catastrophe modelling and insurance – the example of the Attica earthquake risk Catastrophe model.

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*	Powerpoint presentations
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. Essays (100%)

Activity	***Semester workload***
Lectures	36
Essays	50
Homework	39
Course total	***125***

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) The Mechanics of Earthquakes and Faulting (2019). Scholz, C. H., Cambridge University Press ISBN 9781316681473, 519p.
2) Palaioseismology (2009). McCalpin, J.P. (ed.) 2nd Edition: International Geophysics Series, Vol. 95, Elsevier Publishing, 647 p. p
3) Γεωλογία και Σεισμοί (2020). Κουκουβέλας Ι., Κοκκάλας Σ., Ζυγούρη Β. ΔΙΣΙΓΜΑ Εκδόσεις ISBN13: 978-618-5242-94-7. 456 σελ. (in Greek)

- Related academic journals:

1) Journal of Structural Geology
2) Tectonophysics
3) Geomorhology
4) Journal of Geophysical Research
5) Quaternary International
6) Tectonics
7) Geology
8) Quaternary Science Reviews
9) Earth and Planetary Science Letters
10) Nature Communications, Geoscience, Scientific Reports
11) Journal of Seismology
12) Soil Dynamics and Earthquake Engineering
13) Marine Geology
14) Bulletin of the Seismological Society of America
15) Natural Hazards
16) Geophysical Research Letters
17) Geophysical Journal International