8.12 CE0832 – Engineering Seismology and Earthquake Engineering

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0832**	**SEMESTER**	**8**
COURSE TITLE	**Engineering Seismology and Earthquake 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**
	3	4
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	
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV223/

(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 aim of the course is to give the students fundamental concepts of engineering seismology, the understanding of the strong ground motion, the parameters that affect it and its influence on the response of structures.

Upon completion of the course, students will have:

1. Basic knowledge of engineering seismology for the generation of earthquakes, the fault rupture mechanisms, seismometry, seismic wave propagation and accelerograms.
2. In-depth knowledge of the ground motion characteristics.
3. Critical understanding of the effects of strong ground motion on the response of structures.
4. Knowledge and understanding of the response spectra.
5. Knowledge and skills in the signal processing of accelerograms and the construction of response spectra using appropriate specialised software.

6. In-depth knowledge and skills of seismic risk assessment of an area.

Specifically, students will be able to:

1. Have adequate comprehension skills of the parameters of engineering seismology.
2. Know the parameters that affect the ground motion in an examined position.
3. Assess the characteristics of the ground motion and evaluate their impact on the response of structures.
4. Select suitable natural accelerometers for dynamic analyses, based on the examined position.
5. Compose appropriate artificial accelerograms using specialised software.
6. Calculate Fourier and response spectra and seismic loads.
7. Investigate and assess the seismic hazard of an area.
8. Identify the seismic risk and suggest ways to reduce it.
9. Develop personal responsibility and offer scientific opinion.
10. 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:

- Search, analysis and synthesis of data and information, using the necessary technologies.
- Decision Making.
- Autonomous work
- Project planning and management
- Production of free, creative and inductive thinking

(3) SYLLABUS

1. Introduction. Fundamental concepts of engineering seismology. Structure of the earth. Faults, geometry, characteristics and types. Earthquake generation mechanisms and seismic parameters. Seismic waves.
2. Energy release, magnitude and intensity of earthquakes. Relationships between magnitude scales. Empirical relationships between magnitude and fault parameters. Earthquake intensity. Seismicity of Greece. Macroseismic parameters of earthquakes.
3. Strong ground motion. Strong-motion recorders, seismometry, seismographs, accelerometers.
4. Accelerograms, ground motion amplitude, frequency and energy content of ground motion (Fourier spectra, response spectra), duration, Arias intensity.
5. Response spectra. Elastic spectra and design spectra of modern seismic codes.
6. Near field ground motion. Forward-directivity effect.
7. New Generation Attenuation Relationships.
8. Seismic risk assessment.
9. Effect of ground motion on the response of structures.
10. Effect of local soil conditions on ground motion.
11. Management and signal processing of accelerographs using specialised software such as Seismosignal, selection of ground motions and generation of artificial accelerograms.

(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. Communication via email or MS-Teams. Announcements and educational material through the e-learning platform e-Class. Excel and specialised software for static and dynamic analysis.
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 Final written examination: 70% Preparation for the project: 30%

Activity	***Semester workload***
Lectures	39
Preparation for Project	36
Personal Study	35
Course total	**110**

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Pitilakis, K. (2010), Geotechnical Earthquake Engineering, Liberal Books Publications, Athens (in Greek).
2. Tselentis A. (2018), General Seismology – Vol. B Engineering Seismology, Liberal Books Publications, Athens (in Greek).
3. Tselentis A. (2018), General Seismology – Vol. A, Liberal Books Publications, Athens (in Greek).
4. Papazachos V.K., Karakaisis G.F., Chatzidimitriou P.M. (2005), Introduction to Seismology, Ziti Publications, Thessaloniki (in Greek).
5. Papazachos, V., Papazachou, K. (2003), The Earthquakes of Greece, Ziti Publications, Thessaloniki (in Greek).

Foreign Bibliography:

1. Sucuoğlu, H., Akkar, S., Halûk, S., & Sinan, A. (2014). Basic Earthquake Engineering. From Seismology to Analysis and Design. New York City.

Related academic journals:

1. Earthquake Spectra
2. Earthquake Engineering and Structural Dynamics
3. Soil Dynamics and Earthquake Engineering