10.2 CE1012 - Geotechnical Earthquake Engineering

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE1012**	**SEMESTER**	**10**
COURSE TITLE	**Geotechnical 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	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*	Specialization Course (ME)
PREREQUISITE COURSES:	Engineering Seismology (CE0832) English level B2 or higher is required for Erasmus incoming students
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV185/

(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 present to the students the fundamental principles of Earthquake Geotechnical Engineering Design.

Upon completion of the course, students will have:

- Comprehended the basic concepts of Soil Dynamics and Geotechnical Seismic Engineering.
- Understood and critically reviewed the relevant basic theoretical framework.

Specifically, students will be able to:

- Apply the basic theoretical framework to typical in practice problems.

- Assess the practical consequences of ground vibrations as well as of the importance of the seismic design for common geotechnical structures.

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…*

The aim of the course is to equip students with the following general skills:

- Searching for, analyzing of, and synthezing of data
- Individual or group work
- Project planning
- Deductive reasoning

(3) SYLLABUS

The course includes the following items:

1. Introduction: soil dynamics, elements of engineering seismology, elements of structural geology, faults.
2. Soil dynamics: dynamics of simple elastic oscillators, elastic design spectrum, dynamics of two-degree-of-freedom oscillator.
3. Soil dynamics: unidirectional wave propagation within a soil formation, laboratory and in situ soil dynamics tests, elastic and shear modulus.
4. Soil dynamics: wave propagation in two directions, influence of topography.
5. Soil dynamics: cyclic loading of soil material, effect of loading cycles on shear modulus, loss of strength due to liquefaction.
6. Liquefaction and dynamic settlements: estimation, calculation and evaluation of liquefaction, remediation measures, failure due to water flow.
7. Seismic actions on geotechnical structures: amplification of seismic actions on embankments, pseudo-static analysis of slope stability, Mononobe - Okabe method on gravity walls
8. Newmark mfthod: seismic stability of slopes.
9. Vibration of Foundations: complex dynamic stiffness, shallow and deep foundations.
10. Geotechnical design according to the Eurocodes and the Hellenic Antiseismic Code (EAK): basic principles, limit states, types of actions, design methods.

(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.*	

Activity	***Semester workload***
Lectures	39
Literature Study	45
Exercises / Paradigms	36
Literature Study	30

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			
		Course total	**150**
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.*	Written examination, 2,5-hours Problem solving, Multiple choice test, Questions and Answers, Written Essay / Project The evaluation criteria are announced to the students well before the examination; weights per subject /exercise are explicitly indicated. The examination results (including total / partial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc. The examination is in Greek for resident students. Erasmus students are examined in English.		

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Gazetas C. Soil Dynamics and Seismic Engineering - Historical Cases, Simeon Publications, ISBN 978-960-411-657-7 (in Greek).
2. Pittilakis K. Geotechnical seismic engineering, Ziti Publications, ISBN 978-960-456-226-8 (in Greek).

Foreign Bibliography:

1. Kramer S. Geotechnical Earthquake Engineering, Prentice Hall, ISBN 0-13-374943-6
2. Towhata I. Geotechnical Earthquake Engineering, Geotechnical Earthquake Engineering, Springer, ISBN 978-3-540-35783-4.
3. Kokusho T. Innovative Earthquake Soil Dynamics, CRC Press, ISBN 9781138029026
4. Verruijt A. An Introduction to Soil Dynamics, Springer, ISBN 978-90-481-3441-0.
5. Das B. & Luo Z. Principles of Soil Dynamics, CL Engineering, ISBN 9781305389434
6. Idriss I. & Boulanger R. Soil Liquefaction During Earthquakes, EERI, ISBN 978-1932884364
7. Chopra A. Dynamics of Structures Prentice Hall, ISBN 0-13-855214-2