COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDER GRADUATE		
COURSE CODE	2307551	SEMESTER	7th
COURSE TITLE	Design of Earthquake Resistant Structures		

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 classwork	5	7
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
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://civil.teipir.gr/web/index.php?page=alias-33

(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 technical seismology, basic concepts of current seismic codes and skills for the evaluation of the seismic response of structures.

Upon completion of the course, students will have:

1. Basic knowledge of engineering seismology for the cause of earthquakes, recording of earthquakes, seismometry, seismic waves, accelerographs.
2. In-depth knowledge and critical understanding of the theory and principles of the dynamic response of the structures and the seismic design.
3. Knowledge and understanding of the response spectrum.
4. Knowledge and skills in the processing of accelerographs and the creation of response spectra using appropriate software.
5. Knowledge and skills in the calculation and evaluation of the dynamic response of single and multi-degree of freedom systems in seismic excitations.

Specifically, students will be able to:

1. Have adequate comprehension skills of the concepts of technical seismology.
2. Evaluate the seismic response of single and multi-degree of freedom systems with elastic or inelastic behaviour.
3. Evaluate the seismic response of systems with torsional response.
4. Deeply understand the seismic behaviour of a structure through the evaluation of important parameters of the inelastic response, as the ductility, behaviour factor and overstrength.
5. To study and evaluate the capacity of a structure and suggest solutions for its improvement
6. Develop personal responsibility and offer scientific opinion.
7. 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.

(3) Course Content

1. Introduction. Fundamental concepts of engineering seismology. Cause of earthquakes, Recording of earthquakes, Seismometry, Seismic waves, Accelerographs.
2. Elastic seismic response of single-degree-of-freedom systems.
3. Equation of motion, Free vibrations with or without damping, Earthquake response.
4. Response spectrum. Alternative ways of displaying spectra, Effects of foundation conditions on the seismic response.
5. Inelastic response of single-degree-of-freedom systems. Ductility, Behaviour factor, Overstrength – Relations q-μ.
6. Inelastic response spectrum. Design spectrum. Seismic design (force method).
7. Effect of torsion on the seismic response. Torsional response of elastic SDOF systems.
8. Seismic response of multi degree–of–freedom systems. Modal spectrum analysis.
9. Simplified lateral force method of analysis.
10. Basic concepts of current Seismic Codes. Seismic loads. Capacity design.
11. Demonstration of the dynamic response of model structures.

(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.* *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*	

Activity	*Semester workload*
Lectures	39
Classwork	26
Preparation for Project	30
Personal Study	80
Course total	175

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: 80% Preparation for the project: 20%

(5) ATTACHED BIBLIOGRAPHY

1. Karayiannis, Ch., (2013), Design – Behaviour of Reinforced Concrete Structures for Seismic Actions, Thessaloniki: Sofia Publications (in Greek).
2. Penelis, G.G. and Kappos, A. (1990). Earthquake-resistant Concrete Structures. Thessaloniki, Greece: P. Ziti Publications.
3. Kappos, A. and Penelis, G.G. (1996). Earthquake-resistant Concrete Structures, Taylor & Francis.
4. Paulay, T. and Priestley, M. J. N. (1992), Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons, Inc.
5. Bachmann Hugo (1998), Earthquake Protection of Structures, Athens: Gkiourdas Publications (in Greek).
6. Fardis M.N., E. Carvalho, A. Elnashai, E. Faccioli, P. Pinto, A. Plumier (2005), Designers' Guide to EN 1998-1 and EN 1998-5 Eurocode 8: Design of structures for earthquake resistance. General rules, seismic actions, design rules for buildings, foundations and retaining structures. Thomas Telford, London.
7. Avramidis, I., Athanatopoulou, A. Morfidis, K., Sextos, A. (2011), Seismic design of R/C and numerical examples of analysis and design to the Eurocodes (in Greek).
8. Elnashai, A., L. Di Sarno, (2008), Fundamentals of earthquake engineering, Wiley.
9. Anastasiadis, K.K. (2001), Earthquake Resistant Structures, Thessaloniki: Ziti Publications (in Greek).
10. Clough R.W. και Penzien J. (1993), Dynamics of Structures, McGraw-Hill, New York. 2nd Edition.
11. Dowrick, D. J. (1988), Earthquake Resistant Design: For Engineers and Architects, Wiley, 2nd Edition.