

Course guides

250837 - 250837 - Advanced Seismic Resistent Design

Last modified: 12/12/2019

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 753 - TA - Department of Architectural Technology.

Degree: MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2019 **ECTS Credits:** 5.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: FRANCISCO LOPEZ ALMANSA

Others: FRANCISCO LOPEZ ALMANSA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

13317. To dimension civil structures in the presence of seismic forces. To dimension corrective solutions. (Specific competence of the specialization in Earthquake Engineering and Geophysics).
13318. To assess seismic risks. To plan and dimension risk reduction measures. (Specific competence of the specialization in Earthquake Engineering and Geophysics).
13324. To identify all types of structures and materials. To design, plan, implement and maintain structures and buildings in civil works. (Specific competence of the specialization in Earthquake Engineering and Geophysics).
13325. To analyze the structures, by applying advanced methods, design software and structural calculations, from the knowledge and understanding of the forces and their application to the structural typologies used of civil engineering. To perform structural integrity assessment. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

Generical:

13300. To apply advanced knowledge in sciences and technology to the professional or research practice.
13301. To lead, coordinate and develop integrated projects in Geo-Engineering.
13302. To identify and design solutions for geo-engineering problems within ethical, social and legislative frameworks.
13303. To evaluate the impact of Geo-engineering on environment, sustainable social development and the significance of working within reliable and consciensous profesional environment.
13304. To incorporate new technologies and advanced tools in Geo-engineering into profesional and research activities.
13305. To conceive Geo-engineering as a multi-disciplinary field that includes relevant aspects from geology, sismology, hydrogeology, geotechnical and earthquake engineering, geomechanics, physics of porous media, geophysics, geomatics, natural hazard, energy and climate interactions.
13306. To promote innovation for the development of methodology, analyses and solutions in Geo-engineering
13307. To tackle and solve advanced mathematical problems in engineering from the drafting of the problem to the development of formulation and further implementation in computer programs. Particularly, to formulate, code and apply analytical and numerical advanced computational tools to project calculations in order to plan and manage them as well as to interpret results in the context of Geo-engineering and Mining engineering.

TEACHING METHODOLOGY

The subject consists of 3 hours per week of classroom lessons in the classroom; The teacher exposes the concepts and basic materials of the subject, presents examples and carries out exercises.

Support material is used in Power Point file format.

LEARNING OBJECTIVES OF THE SUBJECT

To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.

To analyze, discriminate and integrate geological and geotechnical information in studies and projects.

To dimension civil structures in the presence of seismic forces. To dimension corrective solutions. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

To assess seismic risks. To plan and dimension risk reduction measures. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

To identify all types of structures and materials. To design, plan, implement and maintain structures and buildings in civil works. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

To analyze the structures, by applying advanced methods, design software and structural calculations, from the knowledge and understanding of the forces and their application to the structural typologies used of civil engineering. To perform structural integrity assessment. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

* To have basic and advanced knowledge on the linear or non-linear structural calculation.

* To know and be able to treat different types of structures of interest in earthquake engineering.

* To know the active and passive vibration control methods and techniques in buildings.

* To know and apply advanced techniques of using special and composed materials.

* To have a global vision of how to deal with the main problems regarding the dynamic response of buildings and structures.

* To know and apply the main seismoresistant design and construction regulations.

- Introduction to earthquake-resistant design and construction.

- Structure control basic concepts.

- Active, passive, semi - active and hybrid control.

- Seismic isolation.

- Energy dissipators. Mass dampers (TMD).

- Design and analysis criteria.

- The seismic regulations.

- Seismic regulations in Spain.

- The eurocode EC08.

- Seismic regulations in Latin American countries.

- Rules on non-seismic dynamic actions.

- Conditions of human comfort and security.

STUDY LOAD

Type	Hours	Percentage
Hours large group	19,5	15.59
Hours small group	9,8	7.83
Self study	80,0	63.95
Guided activities	6,0	4.80
Hours medium group	9,8	7.83

Total learning time: 125.1 h

CONTENTS

Earthquake Engineering & Seismology

Description:

Seismic risk
Influence of soil
Near-fault effects

Full-or-part-time: 21h 36m

Theory classes: 9h
Self study : 12h 36m

Earthquake-resistant design

Description:

Conceptual seismic design of buildings
Earthquake-resistant analysis (I)
Earthquake-resistant analysis (II)
Earthquake-resistant analysis (III)
Earthquake-resistant analysis (IV)

Full-or-part-time: 36h

Theory classes: 6h
Practical classes: 9h
Self study : 21h

New technologies

Description:

Base isolation (I)
Base isolation (II)
Base isolation (III)
Energy dissipators
Mass dampers

Full-or-part-time: 36h

Theory classes: 11h
Practical classes: 4h
Self study : 21h

GRADING SYSTEM

The mark is obtained from exercises to be solved outside the classroom; the resolution can be individual or collective.

EXAMINATION RULES.

If any of the exercises is not delivered in the scheduled period, it will be considered as a zero score.



BIBLIOGRAPHY

Basic:

- Day; R.W. Geotechnical earthquake engineering handbook: with the 2012 International Building Code. 2nd ed. New York: McGraw-Hill, 2012. ISBN 9780071792387.
- Kramer S.L.. Geotechnical earthquake engineering. Upper Saddle River, NJ: Prentice Hall, 1996. ISBN 0133749436.
- Bazán E., Meli R. Diseño sísmico de edificios. México: Limusa, 1998. ISBN 9681853495.
- Chandrasekaran, S. Seismic design aids for nonlinear analysis of reinforced concrete structures. Boca Raton ; London ; New York: CRC Press, 2010. ISBN 9781439809143.
- Dowrick D.J. Earthquake resistant design for engineers and architects. Chichester [etc.]: John Wiley and Sons, 1987. ISBN 0471915033.
- Fajfar P., Krawinkler H. Seismic design methodologies for the next generation of codes. Rotterdam: A.A. Balkema, 1997. ISBN 9054109289.
- Newmark N.M., Rosenblueth E.. Fundamentos de ingeniería sísmica. Diana, 1978.
- Paulay T., Priestley M.J.N. Seismic design of reinforced concrete and masonry buildings. New York [etc.]: Wiley & Sons, 1992. ISBN 0471549150.
- Priestley M.J.N., Seible F., Calvi G.M.. Seismic Design and Retrofit of Bridges. John Wiley, 1996.
- Priestley M.J.N.; Calvi G.M.; Kowalski, M.J. Displacement-based seismic design of structures. Pavia: IUSS Press, 2007. ISBN 9788861980006.