

Course guides

250832 - 250832 - Sismometry

Last modified: 12/12/2019

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

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

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

LECTURER

Coordinating lecturer: JOSE ORIOL CASELLES MAGALLON

Others: JOSE ORIOL CASELLES MAGALLON

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 13308. To conceive soils and rocks as porous media governed by Solid and Fluid Mechanics.
- 13310. To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose laboratory testing programmes.
- 13313. To apply the knowledge on soil and rock mechanics to the development of the study, design, construction and exploitation of foundations, excavations, embankments, tunnels and other constructions on or through the soils, regardless of their nature and state or the finality of the works under study. (Specific competence of the specializations in Geotechnical Engineering and 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).
- 13327. To perform studies of seismic hazard. (Specific competence of the specialization in Earthquake Engineering and Geophysics).

General:

- 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 professional 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 course consists of 1,8 hours per week of classroom activity (large size group) and 0,3 hours weekly with half the students (medium size group).

The 1,8 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 0,3 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

LEARNING OBJECTIVES OF THE SUBJECT

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

To characterize the geological environment and its interaction with civil works.

To interpret laboratory tests and field observations so as to identify the mechanisms responsible for soil response. To propose testing programmes.

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

To apply the knowledge on soil and rock mechanics to the development of the study, design, construction and exploitation of foundations, excavations, embankments, tunnels and other constructions on or through the soils, regardless of their nature and state or the finality of the works under study (Specific competence of the specialties in Geotechnical Engineering and Earthquake Engineering and Geophysics).

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 understand, as to advanced applications, the theoretical and practical concepts in seismology.

* To know and be able to treat the different ways to record the seismic waves at a global, regional and local level, as well as the instrumentation used in the near and far fields and also the instrumentation of buildings and structures.

* To know the seismic risk assessment methods and techniques and to be able to carry out studies applied to seismic risk.

* To know and apply subsoil survey techniques by means of destructive geophysical tools and techniques.

* To have a global vision of how to deal with the main problems regarding engineering seismology and earthquake engineering.

- History of the instrumentation: sismoscopy and seismometers.

- The instruments in the twentieth century.

- Dynamic Systems.

- Mechanical and electromagnetic seismometers.

- Displacement transducers, speed and acceleration.

- Instrumentation in the nearby field.

- Instrumentation of buildings and civil works.

- Local, regional, national and global seismic networks.

STUDY LOAD

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

Total learning time: 125.1 h

CONTENTS

Series and Fourier transform

Description:

Definition and application to the seismic instrumentation and treatment of the signals of the series and Fourier transform

Specific objectives:

Understand and learn how to use series and Fourier transform

Full-or-part-time: 7h 11m

Theory classes: 3h

Self study : 4h 11m

History of seismographs

Description:

A story about the history of seismographers and their repercussions on current instruments

Specific objectives:

Understand why some ways to work and proceed today

Full-or-part-time: 2h 24m

Theory classes: 1h

Self study : 1h 24m

Transfer functions

Description:

Understand the functions of transfer, application to the instrumentation and the experimental limitations

Specific objectives:

Understand what they are and how to perform the transfer functions. Application to seismological instrumentation. Understand and know the experimental limitations of transfer functions.

Full-or-part-time: 14h 23m

Theory classes: 6h

Self study : 8h 23m



Filters and windows

Description:

Know how filters and time windows are used and how they are used in instruments and signal processing
Learn how to filter and put windows to a real signal.

Specific objectives:

Understand what filters and temporary windows are. Learn how to handle and use filters and windows. Learn how to create filters and windows.

Learn how to handle and use filters and windows. Learn how to create filters and windows.

Full-or-part-time: 24h

Theory classes: 10h

Self study : 14h

Seismographs

Description:

Learn what digitizers are and how they work.

Learn how and where to place the seismographs. Learn how the seismic networks work and how are.

Specific objectives:

Learn what digitizers are and how they work. Understand the repercussions on quality and cost of each of them.

Learn how and where to place the seismographs. Learn how the seismic networks work and how are.

Full-or-part-time: 28h 47m

Theory classes: 7h

Laboratory classes: 5h

Self study : 16h 47m

Instrumentation and data processing

Description:

Instrument a scale model and analyze the obtained obtained.

Instrument a real building

Specific objectives:

Learning to implement structures. Learn to treat the data obtained and interpret the results.

Perform the instrumentation of a real building and understand the difficulties and limitations that it entails

Full-or-part-time: 16h 48m

Practical classes: 5h

Laboratory classes: 2h

Self study : 9h 48m



GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

EXAMINATION RULES.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

BIBLIOGRAPHY

Basic:

- Havskov, J.; Alguacil, G. Instrumentation in earthquake seismology [on line]. 2nd ed. Cham: Springer International Publishing, 2016 [Consultation: 27/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=4095872>. ISBN 9783319213149.