250837 - Advanced Seismic Resistent Design

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 753 - TA - Department of Architectural Technology
Academic year: 2019
Degree: MASTER'S DEGREE IN GEOTECHNICAL ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: FRANCISCO LOPEZ ALMANSA
Others: FRANCISCO LOPEZ ALMANSA

Opening hours
Timetable: wednesday 16:30-18:30

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).

General:
13300. To apply advanced knowledge in sciences and technology to the profesional 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 conscientious 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.
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.
- 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.
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## Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 125h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>19h 30m</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>9h 45m</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>9h 45m</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>6h</td>
</tr>
<tr>
<td>Self study:</td>
<td>80h</td>
</tr>
</tbody>
</table>

### Content

### Earthquake Engineering & Seismology

**Learning time:** 21h 36m  
- Theory classes: 9h  
- Self study: 12h 36m

**Description:**  
- Seismic risk  
- Influence of soil  
- Near-fault effects

### Earthquake-resistant design

**Learning time:** 36h  
- Theory classes: 6h  
- Practical classes: 9h  
- Self study: 21h

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

### New technologies

**Learning time:** 36h  
- Theory classes: 11h  
- Practical classes: 4h  
- Self study: 21h

**Description:**  
- Base isolation (I)  
- Base isolation (II)  
- Base isolation (III)  
- Energy dissipators  
- Mass dampers
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## Qualification system

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

## Regulations for carrying out activities

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

## Bibliography

### Basic: