250713 - Experimental Techniques for the Characterization of Structural Materials

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015).
ECTS credits: 5
Teaching languages: Spanish

Teaching staff
Coordinator: ROLANDO ANTONIO CHACÓN FLORES
Others: ANTONIO AGUADO DE CEA, DIEGO FERNANDO APONTE HERNÁNDEZ, JESÚS MIGUEL BAIRÁN GARCÍA, JUAN RAMON CASAS RIUS, ROLANDO ANTONIO CHACÓN FLORES, LUCA PELA, ESTHER REAL SALADRIGAS, IGNACIO SEGURA PEREZ

Opening hours
Timetable: The hours of attention will be Friday morning. Alternatively, students can schedule meetings by contacting directly with each professor by e-mail.

Degree competences to which the subject contributes

Specific:
13364. To conceive and design civil and building structures that are safe, durable, functional and integrated into its surroundings.
13365. Designing and building using traditional materials (reinforced concrete, prestressed concrete, structural steel, masonry, wood) and new materials (composites, stainless steel, aluminum, shape memory alloys?).
13366. To evaluate, maintain, repair and strengthen existing structures, including the historic and artistic heritage.
13368. Mathematically modelling structural engineering problems.
13369. To apply methods and advanced design software and structural calculations, based on knowledge and understanding of forces and their application to the structural types of civil engineering.

Generic:
13360. To conceive, design, analyze and manage structures or structural elements of civil engineering or building, encouraging innovation and the advance of knowledge.
13361. To develop, improve and use conventional materials and new construction techniques to ensure the safety requirements, functionality, durability and sustainability.
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**Teaching methodology**

Different activities are developed throughout the course for the sake of providing an interesting learning environment. The activities are somehow separated in two blocks.

- Let's measure. Attendees learn in a hands-on fashion how to use measurement equipment. Low-cost sensors and open-source microcontrollers are used for this purpose. Engineering problems related to forces, displacements, accelerations, temperature, humidity, etc are set as case studies.

- Lectures and laboratory sessions. A journey for state-of-the-art techniques related to the analysis of steel structures, concrete structures, building and bridges and other cementitious materials are given.

All educational resources are given in ATENEA, the Learning Management System

**Learning objectives of the subject**

Subject to act in front of practical engineering problems related to the characterization of building materials

Capability to define the tests to be applied to a structure with damage in their structural evaluation, and define the criteria for monitoring the construction process of a singular structure


The main objectives of the course are:

- To provide a framework for the experimental analysis of engineering problems infused with critical thinking and scientific method. The communication of the results is performed by the production of papers, posters, videos and oral presentations

- To provide knowledge related to experimental techniques, monitoring, material characterization and other methodologies useful in civil engineering problems.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 19h 30m</th>
<th>15.60%</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 9h 45m</td>
<td>7.80%</td>
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<tr>
<td></td>
<td>Laboratory classes: 9h 45m</td>
<td>7.80%</td>
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<td></td>
<td>Guided activities: 6h</td>
<td>4.80%</td>
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<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
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## Content

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Learning time: 7h 11m</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study : 4h 11m</td>
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**Description:**
- Scientific method
- Preparation of scientific and technical documents

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<tr>
<th>Block 2</th>
<th>Learning time: 36h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 9h</td>
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<tr>
<td></td>
<td>Practical classes: 3h</td>
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<tr>
<td></td>
<td>Laboratory classes: 3h</td>
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<tr>
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<td>Self study : 21h</td>
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**Description:**
- Sensors
- Data acquisition systems
- Graphical User Interface
- These sessions include two development practices with the scholarship holders of the subject

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<tr>
<th>Block 3</th>
<th>Learning time: 50h 24m</th>
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<tr>
<td></td>
<td>Laboratory classes: 21h</td>
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<tr>
<td></td>
<td>Self study : 29h 24m</td>
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**Description:**
- Experimental techniques in steel structures
- Experimental techniques for structural concrete
- Experimental techniques for cementitious materials
- Experimental techniques in masonry structures
- Experimental techniques for bridges
Qualification system

The marks are obtained by the following activities:

*** Critical analysis of a scientific research from reputed journals.

*** Development of a measurement artifact.

*** Writing of a scientific report with results from the measurement experience.

** Research related to cutting-edge experimental techniques.

*** Development of a communication poster.

*** Short test.

Regulations for carrying out activities

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:


