



Course guide

250713 - 250713 - Experimental Techniques for the Characterization of Structures and Structural Materials

Last modified: 19/06/2024

Unit in charge: Barcelona School of Civil Engineering

Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2024

ECTS Credits: 5.0

Languages: Spanish

LECTURER

Coordinating lecturer: ROLANDO ANTONIO CHACÓN FLORES

Others: DIEGO FERNANDO APONTE HERNÁNDEZ, ITSASO ARRAYAGO LUQUIN, JESÚS MIGUEL BAI RÁN GARCÍA, JUAN RAMON CASAS RIUS, ROLANDO ANTONIO CHACÓN FLORES, NOEMÍ DUARTE GÓMEZ, LUCA PELA, CAROLINA PUIG POLO, NIKOLA TOSIC

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.

Generical:

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.

TEACHING METHODOLOGY

Different activities are carried out with the aim of improving students' learning and skills in dealing with practical problems. The included activities are divided into two groups, which are explained below.

"Vamos a medir" (Let's Measure): Students learn practically how to use measurement equipment and low-cost sensors to evaluate physical parameters that help determine the state of elements or structures (deflection, displacement, vibration, temperature, humidity, among others). They also learn how to assemble automatic measurement systems that can be easily installed on the structure or elements to evaluate their behavior. A set of sensors and an Arduino board are provided for students to practice and assemble their own system to perform measurements in the laboratory.

Theoretical-Practical Classes: A compendium of information related to different experimental techniques used by different groups in the section is presented. It covers experimental techniques in the fields of metal construction, concrete, building, bridges, and materials. Emphasis is placed on the use of Laser Scanner and computer vision techniques are introduced.

Support material in the form of a detailed teaching plan is provided through the virtual campus ATENEA. It includes content, the program of learning activities, and literature on the topics studied.

Although most sessions will be conducted in the language indicated in the guide, sessions in which there is occasional support from other guest experts may be conducted in another language.

LEARNING OBJECTIVES OF THE SUBJECT

Course on how to face real-life problems in the field of engineering with regards to the characterization of structures and building materials. It includes training on the basic use and prototyping of sensors, data acquisition systems and graphic user interfaces.

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

Scientific and analytical method. Characterisation of physical properties. Characterization of properties related to durability. Characterization of mechanical properties. Instrumental techniques . Monitoring structures. Preparation of technical documents and presentations

The main objectives of the course are:

Provide a learning experience for the use and development of various experimental techniques for characterizing structures and materials based on sensors, imaging, and point clouds.

Provide a learning experience with diverse materials and structural typologies.

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Self study	80,0	63.95
Hours large group	25,5	20.38
Hours medium group	9,8	7.83

Total learning time: 125.1 h



CONTENTS

Block 1

Description:

Sensors
Data acquisition systems
Graphical User Interface
These sessions include two development practices

There is also a practical session of scanning a real scene which is subsequently processed using computational geometry tools.

Specific objectives:

Introduce the use sensors and remote sensing techniques in Construction

Full-or-part-time: 18h

Theory classes: 3h
Practical classes: 3h
Laboratory classes: 3h
Self study : 9h

Block 2

Description:

Experimental techniques for structural concrete
Experimental techniques in steel structures
Experimental techniques for cementitious materials
Experimental techniques in masonry structures
Experimental techniques for bridges

Full-or-part-time: 24h

Theory classes: 18h
Self study : 6h

GRADING SYSTEM

The final grade for the subject is obtained from the continuous assessment grades and the corresponding laboratory and/or computer classroom grades.

Continuous assessment involves completing various activities, both individual and group-based, that are additive and formative in nature, carried out throughout the course (inside and outside the classroom).

- Development of a measuring instrument
- Presentation of results report
- Communication and dissemination of the conducted research using posters or videos
- Final Exam

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:

- Suryanarayana, C. Experimental techniques in materials and mechanics [Rekurs electrònic] [on line]. Boca Raton [etc.]: CRC Press, cop. 2011 [Consultation: 18/02/2021]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1449586>. ISBN 9781439895238.
- Silyn-Roberts, H. Writing for science and engineering : papers, presentations and reports. 2nd ed. Oxford: Butterworth-Heinemann, 2013. ISBN 9780080982854.
- Organtini, G. Scientific Arduino programming [on line]. Roma: Sapienza Università di Roma, 2015 [Consultation: 28/04/2020]. Available on: <https://openlibra.com/es/book/scientific-arduino-programming>.
- Blanco Díaz, Elena; Oller, S; Gil Espert, Lluís. Análisis experimental de estructuras. Barcelona: CIMNE, 2008. ISBN 9788496736474.