Experimental Techniques for the Characterization of Structures and Structural Materials (250713)

General information

School:	ETSECCPB
Departments:	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits:	5.0 ECTS
Programs:	MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ, pla 2015 - (codi pla 1140)
Course:	2015/2016
Course language:	Castellano

Faculty

Responsible faculty: Sergio Henrique Pialarissi Cavalaro

Teachers: Ana Blanco Álvarez, Rolando Antonio Chacón Flores, Sergio Henrique Pialarissi Cavalaro, Pablo Pujadas Álvarez

Generic objectives

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:

- Strengthen the capacity for critical analysis and integrated vision to address real engineering problems using the scientific method

- Transmit test procedures for characterizing materials and how to process and analyze the results

- Pave the way for the drafting scientific papers and technical reports

- Put knowledge into practice through case studies and development of monitoring systems

The course is divided according to the three blocks described below, which promote a transversal and integrated learning.

Block 1. Scientific method, scientific-technical writing and oral presentation: This block provides basic knowledge about the application of the scientific method on how to solve real engineering problems. General guidelines on how to design characterization and monitoring campaigns are given. The basis on writing scientific papers and technical reports, as well as oral presentations of these works, is transmitted.

Block 2. Measurement techniques. The physical magnitude to its corresponding digital data storage. In this block, the students have a complete experience of measuring a magnitude with a manufacturing and digital modeling (FMD) tool. The prototypes developed by the students have close relation with the used in the monitoring of structures.

Block 3. Learning and applying knowledge through case studies. In this block knowledge of the experimental methods, processing, interpretation and analysis of the results are internalized. To do this, groups of students focus on real cases of structures with problems (tunnels, dams, precast industry, among other). In a first stage, the group should propose a campaign of characterization of materials or structure. In a second stage, the results from the experimental campaign conducted in practice are analyzed by the groups that should reach a conclusion about the causes of the problem. The proposals made by the groups are discussed.

The course consists of lectures (35% of the time), group work (30% of the time) and joint discussion of case studies (35% of the time).

Skills

Specific skills

To conceive and design civil and building structures that are safe, durable, functional and integrated into its surroundings.

Designing and building using traditional materials (reinforced concrete, prestressed concrete, structural steel, masonry, wood) and new materials (composites, stainless steel, aluminum, shape memory alloys?).

To evaluate, maintain, repair and strengthen existing structures, including the historic and artistic heritage.

Mathematically modelling structural engineering problems.

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 skills of subject

To conceive, design, analyze and manage structures or structural elements of civil engineering or building, encouraging innovation and the advance of knowledge.

To develop, improve and use conventional materials and new construction techniques to ensure the safety requirements, functionality, durability and sustainability.

ECTS credits: total hours of student work

		Dedication	
		Hours	**Percent**
Supervised Learning	**Theory**	24.00	53.3%
	Assignments	0.00	0.0%
	Laboratory	21.00	46.7%
	Supervised activities	9.00	20.0%
Self-Learning		80.00	

Contents

Block 1

Dedication

12.0h. Theory

Description

Scientific method

Design of experimental campaigns and parametric studies

Preparation of scientific and technical documents

Basics treatment results

Block 2

Dedication

6.0h. Theory + 6.0h. Laboratory

Description

Basics of sensing and monitoring of materials and structures

Introduction to manufacturing tools and digital modeling (FMD)

Prototype assembly with sensors

Block 3

Dedication

6.0h. Theory + 15.0h. Laboratory

Description

Techniques for evaluation of physical and mechanical properties

Technique for characterization of the microstructure and chemical composition

Case Study: Proposed campaign exprimental

Case Study: Analysis of the results of the experimental campaign

Activities

Presentation of prototypes for sensing

Dedication

3.0 h. Supervised activities

Presentation of the proposal concerning the experimental campaign case study

Dedication

3.0 h. Supervised activities

Description

Delivery of report and oral presentation of the work.

Final case study report

Dedication

3.0 h. Supervised activities

Description

Actual handing over of the final report concerning the case study and oral presentation.

Grading rules (*)

(*) The evaluation calendar and grading rules will be approved before the start of the course.

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.

Test rules

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

Teaching methodology

The course consists of 3 hours per week of classroom activity (large size group).

The 2 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 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.

Office hours

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

Basic bibliography

- C. Suryanarayana. **Experimental Techniques in Materials and Mechanics**. CRC Press . 2011. ISBN 9781439819043.
- H Silyn-Roberts. **Writing for Science and Engineering, 2nd Edition**. 2012. ISBN 9780080982861.