Course guides
2500047 - GECINTGEST - Introduction to Structure Management

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

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Optional subject).
Academic year: 2021 ECTS Credits: 4.5 Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: JUAN RAMON CASAS RIUS
Others: VICENTE ALEGRE HEITZMANN, JUAN RAMON CASAS RIUS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14411. Knowledge about the project, calculation, construction and maintenance of building works in terms of structure, finishes, facilities and own equipment. (Specific technology module: Civil Construction)

General:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.
14383. Ability to project, inspect and direct works, in their field.
14386. Capacity for maintenance, conservation and exploitation of infrastructure, in its field.
14389. Knowledge of the history of civil engineering and training to analyze and assess public works in particular and construction in general.
14391. Conceive, project, manage and maintain systems in the field of construction engineering. Cover the entire life cycle of an infrastructure or system or service in the field of construction engineering. (Additional school competition).

TEACHING METHODOLOGY

The course consists of 1.5 hours per week of classroom activity (large size group) and 1.5 hours weekly with half the students (medium size group).

The 1.5 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 1.5 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.

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**

Introduction of the aspects related with the lifetime and with the serviceability behavior of the civil engineering structures. Main pathologies and degradation processes in structures throughout the lifetime. Non-destructive inspection and testing techniques for concrete and steel structures. Repair and strengthening materials and techniques.

1. Ability to identify the main pathologies in concrete structures, and steel, foundations and pavements from inspection, and definition of tests.
2. Ability to establish both static and dynamic load tests.
3. Ability to define structural strengthening solutions based on the different materials of the original structure.

Introduce the student to aspects related to the lifetime and serviceability behavior of civil engineering structures (inspection, maintenance and repair of existing structures). The objective is to complement the previous aspects of planning, project and construction that have been seen in other subjects of the degree. Identification of pathologies. Inspection techniques, destructive tests and non-destructive tests on concrete and steel structures. Definition of load tests. Techniques for strengthening structures, foundations and pavements.

**STUDY LOAD**

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>22,5</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>4,5</td>
<td>4.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>22,5</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>63,0</td>
<td>56.00</td>
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**Total learning time**: 112.5 h

**CONTENTS**

**Main defects and damages structures**

**Description:**

Critical analysis of the main defects and pathologies most common in civil engineering and building structures through real examples. Most important points to take into account when doing the first visual inspection of a damaged structure. The most common ways of reflecting the results of an inspection report are presented, including an initial diagnosis of the possible causes of the damage. To this end, helpful bibliographic materials are presented.

Defects in the project phase (design of the structure, calculation and dimensioning)

Defects in the quality of materials.

Defects in execution phase: falsework, formwork, construction detailing

**Full-or-part-time**: 21h 36m

Theory classes: 9h

Self study: 12h 36m
### Inspection and testing of concrete structures

**Description:**
Principles of operation of the most common non-destructive testing techniques in concrete structures and their accuracy and field of application.
Core drilling of samples: main applications and influence of various parameters on the result of the compression test of samples
Methods for estimating the compressive strength of concrete based on the measurement of surface hardness, mainly focusing on the main factors that may influence the test result.
Ultrasonic methods for determining the resistance and modulus of deformation of hardened concrete are presented. The main factors that may affect the results and their interpretation are also discussed.
Tests to determine durability: carbonation, chloride content, porosity.

**Full-or-part-time:** 24h
Theory classes: 10h
Self study: 14h

### Inspection and testing of steel structures

**Description:**
Main methods of non-destructive testing of steel structures: penetrating liquids, magnetic particles, ultrasound, radiography, acoustic emission.

**Full-or-part-time:** 4h 48m
Theory classes: 2h
Self study: 2h 48m

### Summary of non-destructive testing of concrete and steel structures

**Description:**
Synthesis. Comparison and criteria of applicability of the different non-destructive testing methods.

**Full-or-part-time:** 2h 24m
Theory classes: 1h
Self study: 1h 24m

### Load tests

**Description:**

**Full-or-part-time:** 8h 24m
Theory classes: 2h
Laboratory classes: 1h 30m
Self study: 4h 54m
Repair and strengthening

Description:
Objectives of surface preparation. Mechanical, thermal and chemical methods
Inorganic-based, organic-based mortars and concretes (organic polymers) and additives with thermoplastic and thermoset polymers

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

Reinforcement with reinforced concrete

Description:
Introduction to the reinforcement of structures. Variables to consider in structural repair and strengthening
Wrapping methods for strengthening members in compression and bending, as well as other bending reinforcement methods are studied.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Reinforcement with structural steel

Description:
Explanation on how changes in the structural scheme of load transmission should be taken into account

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Reinforcement with prestressing and composites

Description:
Introduction to composite materials. Main types of composite materials. Methods of application of reinforcement in compressed and bending elements. Modes of failure. Failure by delamination and peeling

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m
### Pathologies and reinforcement of foundations

**Description:**
Shallow reinforcement acting on the foundation structure. Shallow reinforcement acting on the foundation ground. Improvement of ground conditions, superficial and deeper
Terrain sewing techniques
Concept of deep strengthening. Micropiles. Jet grouting. Load transfer mechanisms from the actual structure to the reinforcement

**Full-or-part-time:** 9h 36m
Theory classes: 4h
Self study: 5h 36m

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### Pathology and pavement reinforcement

**Description:**
 Loads considered. Types of joints and pins
Typical defects in the execution phase: poured thicknesses, reinforcement and position. Characterization of concrete. Work stresses to consider

**Full-or-part-time:** 10h 48m
Theory classes: 3h
Laboratory classes: 1h 30m
Self study: 6h 18m

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### 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.

If any of the continuous assessment activities is not carried out in the scheduled period, it will be considered as a zero score in this activity.
BIBLIOGRAPHY

Basic:

Complementary: