Course guide
2500039 - GECFPRETEN - Prestressed Concrete

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: 2022 ECTS Credits: 4.5 Languages: Spanish

LECTURER
Coordinating lecturer: JUAN MURCIA DELSO
Others: ALBERTO DE LA FUENTE ANTEQUERA, EDUARDO GALEOTE MORENO, JUAN MURCIA DELSO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14410. Knowledge of the typology and calculation bases of prefabricated elements and their application in manufacturing processes. (Specific technology module: Civil Construction)
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)
14415. Ability to apply construction procedures, construction machinery and construction planning techniques. (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.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.
LEARNING OBJECTIVES OF THE SUBJECT


1. Ability to identify the different prestressing systems and the behavior of the materials used.
2. Ability to establish the basis of calculation of prestressed structures and to evaluate the prestressing force considering both instantaneous and long-term losses.
3. Ability to assess the limit states of prestressed structures, and the criteria and distribution of passive and active reinforcement.

Fundamental knowledge for the project and calculation of prestressed concrete structures with the aim of satisfying safety, durability and serviceability requirements. Technological aspects associated with the construction of these type of structures. Project Bases of prestressed concrete structures. Structural analysis of the prestressed force. Calculation of the prestressed force and the prestressing layout. Calculation of instantaneous and long-term losses. Verification of Serviceability limit state of deformability. Verification of ultimate limit states. Reinforcement details. Anchorage Area.

Acquire fundamental knowledge for the design and calculation of prestressed concrete structures in order to meet the requirements of safety, durability and functionality; as well as knowing the technological aspects associated with their construction.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>22,5</td>
<td>20.00</td>
</tr>
<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>Self study</td>
<td>63,0</td>
<td>56.00</td>
</tr>
</tbody>
</table>

Total learning time: 112.5 h

CONTENTS

Introduction

Description:
Introduction to prestressed concrete

Full-or-part-time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study : 4h 11m

Prestressing technology

Description:
Prestressing technology

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m
## Behavior of materials

**Description:**
- Instant and delayed response of the concrete
- Instantaneous and delayed response of reinforcing and prestressing steels
- Calculation of deformations and stresses in concrete and steel

**Full-or-part-time:** 9h 36m  
Theory classes: 3h  
Practical classes: 1h  
Self study: 5h 36m

## Bases for calculating prestressed concrete structures

**Description:**
- Safety and durability. Limit state method.  
- Prestressing actions. Effects on isostatic and hyperstatic structures.  
- Example of structural analysis of the prestressed.

**Full-or-part-time:** 9h 36m  
Theory classes: 3h  
Practical classes: 1h  
Self study: 5h 36m

## Evaluation of prestressing force

**Description:**
- Instant prestressing losses  
- Elongation of active reinforcements and tensioning order.  
- Deferred prestressing losses.  
- Example of prestressing losses and active armature elongation

**Full-or-part-time:** 12h  
Theory classes: 3h  
Practical classes: 2h  
Self study: 7h

## Exam

**Full-or-part-time:** 7h 11m  
Laboratory classes: 3h  
Self study: 4h 11m
## Limit states

**Description:**
Criteria for Cracking Limit States  
Sizing of the prestressing force  
Example of sizing of the prestressing force  
ELS of deformations  
ELU Flexocompression  
Example ELU Flexocompression  
ELU Shear  
ELU shear lag  
Example ELU shear lag  
Prestress anchorage  
Example design anchorage area

**Full-or-part-time:** 42h  
Theory classes: 10h 30m  
Practical classes: 7h  
Self study: 24h 30m

## Criteria and arrangement of reinforcement

**Description:**  
Aspects of constructive details and arrangement of reinforcements

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

## Applications of prestressed concrete

**Description:**  
Prefabrication  
Applications of prestressed concrete in bridge engineering, public works and construction

**Full-or-part-time:** 6h  
Theory classes: 2h 30m  
Self study: 3h 30m

## Exam

**Full-or-part-time:** 7h 11m  
Laboratory classes: 3h  
Self study: 4h 11m
GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment.

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.

In the course of Prestressed Concrete, the continuous evaluation consists on the following activities:

a) 2 individual tests (E1 and E2) to be presented along the course. These tests will be conducted within class time.

b) Practical course work (T) consisting in the design of a prestressed concrete structure.

c) Participation in activities developed in class (P). These activities will be developed in class.

The final grade of the course, over 10 points, will be obtained as: \[ FG = 0.25 \cdot E1 + 0.35 \cdot E2 + 0.35 \cdot T + 0.05 \cdot P \]

In order to pass the course a final grade greater than or equal to 5.0 is needed.

Criteria for re-evaluation qualification and eligibility: students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

BIBLIOGRAPHY

Basic: