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, EVA MARIA OLLER IBARS

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)

Generic:
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


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>
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</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 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.

BIBLIOGRAPHY

Basic: