Course guide
2500046 - GECEDIPREF - Building Construction and Prefabrication

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: 7.5 Languages: Catalan

LECTURER
Coordinating lecturer: PEDRO ROCA FABREGAT
Others: DANIEL ALARCÓN FERNÁNDEZ, GIORGIO ANITORI, PEDRO ROCA FABREGAT

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)

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 2.5 hours per week of classroom activity (large size group) and 2.5 hours weekly with half the students (medium size group).

The 2.5 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 2.5 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 establish the bases of calculation in the design of structures, based on the regulations of existing actions, calculation and execution.
2. Capacity for designing and/or verifying structures in complex cases: plate analysis, rupture methods, introduction to elasticity and finite element method.
3. Capacity for dynamic and seismic analysis of simple cases. 3.4 Knowledge of the design, calculation, construction and maintenance of building works in regard to their structure, finishes, installations and equipment.


STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>105,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>37,5</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>37,5</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>7,5</td>
<td>4.00</td>
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Total learning time: 187.5 h
CONTENTS

THE SUBSYSTEMS OF THE BUILDING AND THEIR INTERACTION

Description:

Specific objectives:
Knowledge of the functions, elements and systems that make up the building. Analysis of the problems derived from the interaction between the different subsystems (enclosures, installations and structure) and of the main arrangements that allow the optimization of their superposition in the building.

Full-or-part-time: 12h
Theory classes: 5h
Self study : 7h

BUILDING PHYSICS

Description:

Specific objectives:
Knowledge of the characteristics and parameters of the interior environment of buildings. Analysis of the thermal conditions and the operation of the thermal insulation of the building. Presentation of thermally insulating materials and elements. Practical implementation of the concepts and theoretical formulation related to the verification of thermal conditions and condensation of water vapor.
Knowledge of the effects of fires on buildings and the levels and solutions that are applicable to their protection. Knowledge of the resistant behavior of various structural materials in the face of fire. Approach to the basic methods of analysis of buildings against fire.
Practical application of the concepts acquired in relation to the verification of the fire resistance of buildings Knowledge of the acoustic behavior of buildings and solutions for improving levels of insulation and comfort. Approaching the problem from the physical point of view. Compliance with current regulations and familiarization with improvement solutions.

Full-or-part-time: 28h 47m
Theory classes: 8h
Practical classes: 4h
Self study : 16h 47m
THE PROTECTIVE SYSTEM

Description:
General considerations on the external envelope of the Building. Morphology and functions of the outer envelope. Order and contact between the resistant, thermal and watertight enclosures. Problems related to the contact between the envelopes: thermal incompatibility and formation of thermal bridges.

Specific objectives:
Understanding of the problems that result from the contact between the structural and protective layers. Presentation of the problems of the conventional solutions and proposal of optimal solutions. Presentation of the main types of solutions for facades, roofs and partitions, with their corresponding advantages and disadvantages.

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

STRUCTURAL ELEMENTS (1)

Description:
Nature of the various gravitational actions. Nature and characteristics of the different live loads and their associated uses. Fundamental types of ceramic, wood, reinforced or prestressed concrete, in situ or prefabricated concrete, steel and composite slabs. Devices used to enhance the monolithism connection of load bearing elements (compression layer, perimeter beams and intermediate nerves).

One-way concrete slabs. Fundamental types. Analysis of the resistant characteristics along with the constructive aspects, specific types and most common uses. Elements of the slab and conditions that must be met. Slab formation and required geometric conditions. Methods based on the plastic redistribution of moments. Concept of active deflection and verification of the deformability. Constructive details for the formation of supports on various types of bearing elements. General slab reinforcement detailing.

Detailed presentation in class of the practical process related to the complete design and verification of a one-way slab. General types and range of use depending on the span and overload. Approach to the virtual gantry method. Edge beams: importance, functions and sizing criteria. General criteria for the reinforcement of two-way slabs. Punching verification: description of the breaking and checking mechanism. Sizing of steel capitals and abacuses.


Specific objectives:
Assessment of actions that may act on buildings
Knowledge of the various types of slabs and the devices used to guarantee the necessary slab monolithism and the appropriate connection with the vertical structure of the building.
Knowledge of the types of unidirectional slabs of reinforced or prestressed concrete. Familiarization with the criteria and the calculation process in service and in ultimate conditions. Knowledge of construction details.
Practical demonstration of the design process and resistant verification of a one-way slab.
Knowledge of the types of two-way reinforced concrete slabs. Presentation of the criteria and the verification process in service and in ultimate conditions. Knowledge of construction details. Analysis of the resistance to punching on pillars and presentation of specific reinforcement details.
Practical demonstration of the design process and strength verification of a two-way floor slab.
Knowledge of the advantages of post-tensioning in the formation of slabs for buildings. Presentation of specific constructive and technological aspects.
Knowledge of the main characteristics and applications of the composite slabs consisting of a steel profiled deck and concrete.

Full-or-part-time: 36h
Theory classes: 10h
Practical classes: 5h
Self study : 21h
STRUCTURAL ELEMENTS (2)

Description:
Exercise related to the practical application of the methods for the resistant verification of a structural system consisting on masonry load-bearing walls.
Introduction to shallow foundations for buildings. Main elements and structural types. Design of footings and mat foundations. Use and design of centering and tie beams for shallow foundations. Use and design of basement walls. Specific construction details.
Detailed presentation of the practical application of the criteria and methods for the design and resistant verification of shallow foundations for buildings.
Introduction to deep foundations for buildings. Main elements and structural types. Use and design of piles, pile-caps and tie beams. Specific construction details.
Practical application of the criteria and methods for the design and resistant verification of deep foundations for buildings.

Specific objectives:
Presentation of the types of masonry walls and the characteristics of the component materials. Knowledge of the basic resistant mechanisms and possible modes of failure at the level of small composite specimens, structural element (wall) and buildings consisting of structural walls.
Practical implementation of the concepts and methods for the resistant verification of a structural system consisting of masonry load-bearing walls.
Knowledge of the specific construction elements and types of shallow foundations for buildings.
Practical demonstration on the design and resistant verification of a shallow foundation for a building.
Practical application of the criteria and methods for the design and resistant verification of deep foundations for buildings.
Practical demonstration on the design and resistant verification of a deep foundation for a building.

Full-or-part-time: 33h 36m
Theory classes: 8h
Practical classes: 6h
Self study: 19h 36m

GLOBAL CONSTRUCTION DETAILS

Description:

Specific objectives:
Discussion on the function and formation of different types of joints in the structure of buildings.

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

Description:
Practical development of the design process of a precast concrete element.

Specific objectives:
- Presentation of precast concrete as a building material and construction technique. Discussion of the main technological aspects.
- Discussion of the main applications of precast concrete for the construction of structures of public works and buildings. In each case, presentation of the main elements and systems.
- Practical application of the criteria and procedures allowing the design a precast concrete element.

Full-or-part-time: 24h
Theory classes: 8h
Practical classes: 2h
Self study: 14h

FACILITIES

Description:
Practical design of a installation for a building.

Specific objectives:
- Description of the essential aspects of different types of facilities. The session mainly focuses on facilities that can significantly impact on the structure of the building.
- Knowledge of the procedure for the design of an installation for a building.

Full-or-part-time: 12h
Theory classes: 4h
Practical classes: 1h
Self study: 7h

OTHER ACTIVITIES

Description:
Technical visit to a prefabrication facility

Specific objectives:
Knowledge of the elements and procedures used in the prefabrication of elements for civil works and buildings through a technical visit of a prefabrication facility.

Full-or-part-time: 21h 36m
Practical classes: 5h
Laboratory classes: 4h
Self study: 12h 36m
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.

Failure to perform a continuous assessment activity in the scheduled period will result in a mark of zero in that activity. The activities or assignments to be performed outside the classroom are mandatory and need to be delivered so that the student can be graded from the course.

BIBLIOGRAPHY

Basic:

Complementary: