

250140 - ESTFOR - Concrete Structures

Coordinating unit:	250 - ETSECCPB - Barcelona School of Civil Engineering		
Teaching unit:	751 - DECA - Department of Civil and Environmental Engineering		
Academic year:	2018		
Degree:	BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory) BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)		
ECTS credits:	7,5	Teaching languages:	Catalan, Spanish, English

Teaching staff

Coordinator:	JESÚS MIGUEL BAI RÁN GARCÍA
Others:	JESÚS MIGUEL BAI RÁN GARCÍA, ALBERTO DE LA FUENTE ANTEQUERA, EDUARDO GALEOTE MORENO, ANTONIO RICARDO MARI BERNAT, EVA OLLER IBARS, MAURO POLIOTTI

Opening hours

Timetable:	Prof. Jesus Bairán (Q1). Building C1, Room 201b. Monday: 15:00 - 17:00 Wednesday: 15:00 - 17:00
	Profa. Eva Oller (Q1). Building C1, Room 201a. Wednesday: 12:00 - 14:00 Friday: 10:00 - 12:00
	Prof. Albert de la Fuente (Q1). Building C1, Room 202a. Tuesday: 15:00 - 17:00 Thursday: 15:00 - 17:00

Degree competences to which the subject contributes

Specific:

- 3024. Ability to apply knowledge of construction materials to structural systems. Knowledge of the relation between the structure of materials and the mechanical properties resulting from them.
- 3031. Students will acquire a basic awareness of the behaviour of reinforced concrete and metal structures and the capacity to conceive, design, build and maintain these types of structures.
- 3032. Students will acquire the ability to select the most appropriate methods for calculating and dimensioning structural (reinforced and prestressed) concrete structures and metal structures to which European regulations apply.
- 3037. Knowledge of the different types and basis for calculating prefabricated items and its application to the manufacturing processes.
- 3038. Knowledge of the design, calculation, construction and maintenance of building works in regard to their structure, finishes, installations and equipment.

General:

- 3104. Students will learn to identify, formulate and solve a range of engineering problems. They will be expected to show initiative in interpreting and solving specific civil engineering problems and to demonstrate creativity and decision-making skills. Finally, students will develop creative and systematic strategies for analysing and solving problems.
- 3106. Students will learn to assess the complexity of the problems examined in the different subject areas, identify the key elements of the problem statement, and select the appropriate strategy for solving it. Once they have chosen a strategy, they will apply it and, if the desired solution is not reached, determine whether modifications are required. Students will use a range of methods and tools to determine whether their solution is correct or, at the very least, appropriate to the problem in question. More generally, students will be encouraged to consider the importance of

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creativity in science and technology.

3107. Students will learn to identify, model and analyse problems from open situations, consider alternative strategies for solving them, select the most appropriate solution on the basis of reasoned criteria, and consider a range of methods for validating their results. More generally, students will learn to work confidently with complex systems and to identify the interactions between their components.

3110. Students will learn to plan, design, manage and maintain systems suitable for use in civil engineering. They will develop a systematic approach to the complete life-cycle of a civil engineering infrastructure, system or service, which includes drafting and finalising project plans, identifying the basic materials and technologies required, making decisions, managing the different project activities, performing measurements, calculations and assessments, ensuring compliance with specifications, regulations and compulsory standards, evaluating the social and environmental impact of the processes and techniques used, and conducting economic analyses of human and material resources.

3112. Students will develop an understanding of the different functions of engineering, the processes involved in the life-cycle of a construction project, process or service, and the importance of systematising the design process. They will learn to identify and interpret the stages in preparing a product design specification (PDS), draft and optimise specifications and planning documents, and apply a systematic design process to the implementation and operation phases. Students will learn to write progress reports for a design process, use a range of project management tools and prepare final reports, and will be expected to show an awareness of the basic economic concepts associated with the product, process or service in question.

3113. Students will learn to identify user requirements, to draft definitions and specifications of the product, process or service in question, including a product design specification (PDS) document, and to follow industry-standard design management models. Students will be expected to show advanced knowledge of the steps involved in the design, execution and operation phases and to use the knowledge and tools covered in each subject area to the design and execution of their own projects. Finally, students will assess the impact of national, European and international legislation applicable to engineering projects.

Transversal:

585. ENTREPRENEURSHIP AND INNOVATION - Level 1. Showing enterprise, acquiring basic knowledge about organizations and becoming familiar with the tools and techniques for generating ideas and managing organizations that make it possible to solve known problems and create opportunities.

586. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.

589. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

594. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

584. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

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Teaching methodology

The course has 5 lecture hours per week during autumn term.

The lecture methodology is based on student work and development by means of posed questions and guided project work, which are seen as the main vehicle of transmission and assimilation of concepts. Theoretical lectures present fundamental concepts and deepen the necessary topics.

Active participation is expected throughout the course.

There are additional training activities that will include a visit to construction site, prefabrication plant or to the Structural Technology Laboratory.

Finally, we emphasize the need for active participation of students in course development. It must learn to work without continuous spikes and constant communication between teacher and student learning while enjoying ..

Learning objectives of the subject

Students will acquire a basic understanding of the behaviour of concrete structures and develop the capacity to conceive, design, build and maintain structures of this type.

Upon completion of the course, students will have acquired the ability to: 1. Define the actions and combinations of actions to be considered in the design of a concrete structure. 2. Design and/or check the strength of sections under different kinds of stress, as well as the interaction of multiple stresses. 3. Determine the type of reinforcement, anchorage length and lap length required in the design of a framework. 4. Design and/or check concrete structural elements in the presence of instability phenomena. 5. Design the most common types of concrete structures (slabs, rigid foundations and flexible foundations). 6. Design active reinforcements in isostatic prestressed concrete structures. 7. Check the serviceability limit states for cracking and deformation. 8. Make decisions about the pouring of concrete (placement, compaction, concrete joints, curing, stripping of formwork) and quality control (quality of materials tests and control levels).

Mechanisms that enable reinforced and prestressed concrete structures to withstand stress; Specific aspects related to the materials, design and construction of structures, such as durability strategy; Criteria for selecting the appropriate structural type, pre-design criteria, and methods for thoroughly checking and organising isostatic and hyperstatic reinforced concrete beams and isostatic prestressed concrete beams, as relates to adequate reinforcement and structural viability; Behaviour and cross sections of common types of concrete structures such as slabs, girders, beams, pillars and foundation elements

Study load

Total learning time: 187h 30m	Hours large group:	47h	25.07%
	Hours medium group:	22h	11.73%
	Hours small group:	6h	3.20%
	Guided activities:	7h 30m	4.00%
	Self study:	105h	56.00%

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Content

<p>Introduction to reinforced concrete</p>	<p>Learning time: 4h 48m Theory classes: 2h Self study : 2h 48m</p>
<p>Description: The reinforcement concept History of concrete</p>	
<p>Manufacture and start work</p>	<p>Learning time: 4h 48m Theory classes: 2h Self study : 2h 48m</p>
<p>Description: Manufacturing, transport Sunset at work and curing</p>	
<p>Calculation basis</p>	<p>Learning time: 16h 48m Theory classes: 5h Practical classes: 2h Self study : 9h 48m</p>
<p>Description: States limit Structural safety Actions Practice combinations of actions Rods and straps</p>	
<p>Durability</p>	<p>Learning time: 4h 48m Theory classes: 1h Practical classes: 1h Self study : 2h 48m</p>
<p>Description: Environments. Materials and coatings Practice durability</p>	

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<p>Materials: Calculation basis</p>	<p>Learning time: 9h 36m Theory classes: 3h Practical classes: 1h Self study : 5h 36m</p>
<p>Description: Components and concrete. Mechanical characteristics Rheological properties of concrete Steels. Passive Armor Practice materials BC</p>	
<p>Ultimate limit state requests normal</p>	<p>Learning time: 28h 47m Theory classes: 9h Practical classes: 3h Self study : 16h 47m</p>
<p>Description: Theory classes Classes Practiq</p>	
<p>Ultimate limit state instability</p>	<p>Learning time: 4h 48m Theory classes: 1h Practical classes: 1h Self study : 2h 48m</p>
<p>Description: Theory classes Practical classes</p>	
<p>Ultimate limit state requests tangential</p>	<p>Learning time: 21h 36m Theory classes: 6h Practical classes: 3h Self study : 12h 36m</p>
<p>Description: ELU chopper. Theory classes ELU chopper. Practical classes ELU torsion. Theory classes ELU torsion. Practical classes</p>	

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Limit state and armed anchor	Learning time: 7h 11m Theory classes: 2h Practical classes: 1h Self study : 4h 11m
Description: Arrangement of reinforcement Theory class Practical class	
State boundary service cracking	Learning time: 7h 11m Theory classes: 2h Practical classes: 1h Self study : 4h 11m
Description: Theory class Practical class	
ELS of deformability	Learning time: 4h 48m Theory classes: 1h Practical classes: 1h Self study : 2h 48m
Description: Theory class Practical class	
Structural elements	Learning time: 7h 11m Theory classes: 3h Self study : 4h 11m
Description: Foundations, floors, walls	

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<p>Introduction to prestressed concrete</p>	<p>Learning time: 4h 48m Theory classes: 2h Self study : 2h 48m</p>
<p>Description: The concept of prestressing. History of prestressed concrete Technology prestressed</p>	
<p>Basis of calculation II</p>	<p>Learning time: 14h 23m Theory classes: 4h Practical classes: 2h Self study : 8h 23m</p>
<p>Description: Structural analysis of prestressed. Share. Design in prestressed Practical actions Prestressing force. Losses and Deferred snapshots Practice losses</p>	
<p>E.L. Cracking</p>	<p>Learning time: 7h 11m Theory classes: 2h Practical classes: 1h Self study : 4h 11m</p>
<p>Description: Decompression Sizing prestressing force. Track Practice sizing</p>	
<p>E.L.U. in prestressed</p>	<p>Learning time: 9h 36m Theory classes: 3h Practical classes: 1h Self study : 5h 36m</p>
<p>Description: Flexion. Checking Cutting Practice bending and shear Anchorage</p>	

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Block 1	Learning time: 4h 48m Laboratory classes: 2h Self study : 2h 48m
Block 2	Learning time: 4h 48m Laboratory classes: 2h Self study : 2h 48m
Block 3	Learning time: 12h Laboratory classes: 5h Self study : 7h
Description: Site visit	

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Qualification system

The final grade is obtained from continuous evaluation and the corresponding laboratory and / or computer room activities.

Continuous evaluation consists on performing different activities, both individual or in group, which are additive and implies both training skills and evaluation. These activities are programmed during the course.

The laboratory grade is the average of such the obtained marks on these activities.

The evaluation exams and tests may include both conceptual questions, exercises and problems, associated with the learning objectives of the course.

The final grade will be obtained as:

$$NF = 0.7 E + 0.3 T$$

where:

E: weighted rating exams.

T: weighted rating of works.

The pass mark is 5.0 over 10.0.

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.

Regulations for carrying out activities

Any activity or exam not presented in the expected period will imply a zero score in that evaluation concept.

There is a special call at the end of the course exclusively for presenting midterm examinations that were not performed for justified reasons.

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Bibliography

Basic:

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