

Course guides

250473 - DISAVESTFO - Advanced Design of Concrete Structures

Last modified: 06/10/2020

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

Degree: MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2009). (Optional subject).
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Optional subject).
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Optional subject).
MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2020 **ECTS Credits:** 5.0 **Languages:** English, Spanish

LECTURER

Coordinating lecturer: ANTONIO RICARDO MARI BERNAT

Others: JESÚS MIGUEL BAIRÁN GARCÍA, PABLO GONZALO FERNANDEZ SANCHEZ, ANTONIO RICARDO MARI BERNAT, EVA MARIA OLLER IBARS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

8162. Knowledge of all kinds of structures and materials and the ability to design, execute and maintain structures and buildings for civil works.

8228. Knowledge of and competence in the application of advanced structural design and calculations for structural analysis, based on knowledge and understanding of forces and their application to civil engineering structures. The ability to assess structural integrity.

Transversal:

8559. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding the mechanisms on which scientific research is based, as well as the mechanisms and instruments for transferring results among socio-economic agents involved in research, development and innovation processes.

8560. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

8561. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

TEACHING METHODOLOGY

The course consists of 3 hours per week of classroom activity.

In the classroom activity, the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises 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

Specialization subject in which knowledge on specific competences is intensified.

Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

Contents of specialization at master level related to research or innovation in the field of engineering.

The course on "Advanced design of concrete structures" intends to supplement a basic course of reinforced and prestressed concrete structures and provide a knowledge at the level of structural specialist. One of the objectives is to strengthen the projectual capacity of students by introducing concepts related to design and construction systems. Particular emphasis is made on the "Strut and tie" model as a general method of design, especially suitable for areas of discontinuity. This method is applied to the study of structural elements with geometric or mechanical discontinuity, such as corbels, deep beams or anchorage zones

Related to structural analysis, some aspects studied are the effects of prestressing in statically indeterminate structures as well as long term and nonlinear behaviour, construction effects, and the design of structures partially prestressed, taking into account the service and ultimate limit states.

Limit states not studied in a basic course, such as punching, instability or fatigue are taught.

STUDY LOAD

Type	Hours	Percentage
Self study	80,0	63.95
Hours medium group	9,8	7.83
Hours small group	9,8	7.83
Hours large group	19,5	15.59
Guided activities	6,0	4.80

Total learning time: 125.1 h

CONTENTS

Method of struts and ties

Description:

Struts and ties
Struts and ties. Exercise

Full-or-part-time: 7h 11m

Theory classes: 2h
Practical classes: 1h
Self study : 4h 11m



Structural Elements

Description:

Corbels and deep beams
Short corbels and beams of great depth. Exercise
Anchors in prestressed elements
Plates
Shells

Full-or-part-time: 24h

Theory classes: 8h
Practical classes: 2h
Self study : 14h

Analysis of concrete structures

Description:

Nonlinear behavior of Concrete Structures. Internal forces redistributions
Secondary prestressing moments. Concordant tendon layout
Structural analysis of prestressing. Exercise
Time dependent effects of creep, shrinkages and construction process. Forces redistributions
Time dependent analysis. Exercise
Partially prestressed
Partial prestressing. Exercise

Full-or-part-time: 24h

Theory classes: 7h
Practical classes: 3h
Self study : 14h

Limit States

Description:

ULS of Shear and Punching
ULS shear and punching. Exercises
Ultimate limit state of instability
Ultimate limit state instability. Exercise
Fatigue
Exercise of fatigue strength verification
Fatigue. Exercise

Full-or-part-time: 28h 47m

Theory classes: 7h
Practical classes: 5h
Self study : 16h 47m

Laboratory

Description:

Virtual analysis Lab and Tests at the LTE

Full-or-part-time: 4h 48m

Laboratory classes: 2h
Self study : 2h 48m

Evaluation

Full-or-part-time: 4h 48m

Laboratory classes: 2h

Self study : 2h 48m

GRADING SYSTEM

The evaluation will be continued through one or several course works or exercises (T) and a final exam (E).

The course works (T) will consist of the design or verification of a structure of limited entity, where the course concepts are applied. The final exam (E) will be held at the end of the course consisting on short conceptual questions and/or problems, that allow to demonstrate the ability to apply the structural concepts developed along the course.

The final mark (F) of the course will be a weighted score according to the following formula:

$$F = 0.5 T + 0.5 E$$

To pass the course, a final mark (F) equal to or greater than 5 is necessary.

EXAMINATION RULES.

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

BIBLIOGRAPHY

Basic:

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- Marí, A.R.; Molins, C.; Bairán, J.M.; Oller, E. Formigó armat i pretensat: exercicis curts de bases de càlcul i estats límits, adaptat a la Instrucció EHE-08 [on line]. 2a ed. Barcelona: Edicions UPC, 2009 [Consultation: 29/04/2020]. Available on: <http://hdl.handle.net/2099.3/36837>. ISBN 978-84-9880-390-7.
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- Jiménez Montoya, P. [et al.]. Hormigón armado [on line]. 15a ed. Barcelona: Gustavo Gili, 2009 [Consultation: 23/04/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=3209549>. ISBN 9788425223075.
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- Miguel Sosa, P.F.; Fernández Prada, M.A.; Bonet Senach, J.L.; Martí Vargas, J.R.; Navarro Gregori, J.; Castro Bugallo, M.C.; Pallarés Rubio, L. Proyecto de estructuras de hormigón mediante el método de las bielas y tirantes. 2a ed. ampl. y adapt. Valencia: Ediciones VJ, 2009. ISBN 9788496937826.
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