

Advanced Design of Concrete Structures (250473)

General information

School:	ETSECCPB
Departments:	751 - Departament d'Enginyeria Civil i Ambiental
Credits:	5.0 ECTS
Programs:	1161 - MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012), 872 - MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012), 1140 - MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ (pla 2015)
Course:	2015/2016
Course language:	English

Faculty

Responsible faculty: Jesús Miguel Bairán García

Teachers: Jesús Miguel Bairán García, Antonio Ricardo Mari Bernat, Eva Maria Oller Ibars

Generic objectives

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 Advanced design of concrete structures intend to supplement a basic course of reinforced and prestressed concrete structures and provide a structural specialist level of knowledge. One of the objectives is to strengthen the capacity of students to design by introducing concepts related to project and construction systems. A particular emphasis is given to the struts and ties 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.

In the structural analysis, some aspects are studied such as the effects of prestressing in statically indeterminate structures as well as long term behaviour, 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 shear-friction, punching or fatigue are taught. Finally, a chapter is dedicated to earthquake design of concrete structures, dealing with ductility, confinement, structure of buildings, structural calculations and arrangements of reinforcement to ensure the proper behaviour of the resisting mechanisms.

Skills

Specific skills

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

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.

Generic skills of subject

INNOVATION, EMPLOYABILITY, DEVELOPMENT AND RESEARCH: The ability to develop one's creative and innovative tendencies with the ultimate aim of serving the development and progress of society. The ability to work on a research topic. Employability in managerial posts in all types of companies and public authorities, coupled with initiative and decision-making abilities. The ability to develop one's creative and innovative tendencies with the ultimate aim of serving the development and progress of society. The ability to work on a research topic. Employability in managerial posts in all types of companies and public authorities, coupled with initiative and decision-making abilities.

SUSTAINABILITY AND THE ENVIRONMENT: The capacity for engineering development in the framework of globalisation, sustainability and environmental protection. The ability to analyse the entire life cycle of an engineering project.

KNOWLEDGE DEVELOPMENT: The ability to develop new analytical methods and processes at all levels: conception, design and development. The ability to propose and develop specifications, regulations and rules in engineering following safety and efficiency criteria and using sustainable resources.

ECTS credits: total hours of student work

		Dedication	
		Hours	Percent
Supervised Learning	Theory	23.00	51.1%
	Assignments	10.00	22.2%
	Laboratory	6.00	13.3%
	Supervised activities	6.00	13.3%
Self-Learning		80.00	

Contents

Basis of design and structural reliability

Dedication

2.0h. Theory + 1.0h. Assignments

Description

Semi-probabilistic methods. Accidental actions. Bases of reliability of structures.

Practice

Analysis of concrete structures

Dedication

4.0h. Theory + 4.0h. Assignments

Description

Structural analysis of prestressed

Structural analysis of prestressing. Exercise

Nonlinear Analysis. Redistributions

Nonlinear analysis. Redistributions. Exercise

Limit states

Dedication

6.0h. Theory + 2.0h. Assignments

Description

Ultimate limit state of instability

Ultimate limit state instability. Exercise

Partially prestressed

Partial prestressing. Exercise

Fatigue

Method of struts and ties

Dedication

2.0h. Theory + 1.0h. Assignments + 2.0h. Laboratory

Description

Struts and ties

Struts and ties. Exercise

Laboratory scale test

Structural Elements

Dedication

7.0h. Theory + 1.0h. Assignments

Description

Corbels and deep beams

Short corbels and beams of great depth. Exercise

Anchors in prestressed elements

Plates

Shells

Seismic design

Dedication

2.0h. Theory + 1.0h. Assignments

Description

Seismic design

Practice

Course Work

Dedication

4.0h. Laboratory

Description

Partial homework 1

Partial Homework 2

Activities

Supervised Final Work

Dedication

6.0 h. Supervised activities

Grading rules (*)

(*) The evaluation calendar and grading rules will be approved before the start of the course.

The evaluation will be continued through a series of short practical works (P), one course work (T) and a final exam (E).

Practical works (P) may be proposed to be carried out in the classroom or as homeworks. No more than 8 short works will be proposed. The mark P will consist on the average grade obtained in all proposed works.

The course work (T) consists of a design to be developed along the course as a case study where a significant number of the course contents are applied.

The final exam (E) will be held at the end of the course consisting on short conceptual problems, but require analysis and demonstrate ability to apply concepts.

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

$$F= 0.4 P + 0.3 T + 0.3 E$$

To pass the course, a final mark (F) equal to or greater than 5 and noted on the exam (E) greater than 3.5 are necessary.

Test rules

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

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.

Office hours

Prof. Jesús Bairán: Thursdays from 10.00h to 14.00h, or other hours by appointment. Office C1-201b

Other professors of the course: by appointment.

Basic bibliography

- Murcia, J.; Aguado, A.; Marí, A.R. **Hormigón armado y pretensado: vol. 2.** Edicions UPC. Barcelona. 1993. ISBN 84-7653-357-8.
- Marí, A.R.; Aguado, A.; Agulló, L.; Martínez, F.; Cobo, D. **Hormigón armado y pretensado: ejercicios: adaptado a la instrucción EHE.** Edicions UPC. Barcelona. 1999. ISBN 84-8301-302-9.
- 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.** Edicions UPC. Barcelona. 2009. ISBN 978-84-9880-390-7.
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- Jiménez Montoya, P. [et al.]. **Hormigón armado**. Gustavo Gili. Barcelona. 2009. ISBN 9788425223075.
- Calavera, J. **Proyecto y cálculo de estructuras de hormigón: en masa, armado y pretensado, de acuerdo con la nueva instrucción EHE-08: de acuerdo con el EUROCÓDIGO EC-2**. Intemac. Madrid. 2008. ISBN 9788488764058.
- Naaman, J.. **Prestressed Concrete. Analysis and Design**. Mc Graw Hill. New York. 1982.
- Miguel Sosa, P., 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 bielas y tirantes**. Ediciones VJ. Valencia. 2009. ISBN 978-84-96937-82-6.
- Paulay, T., Priestley, M. J. N. . **Seismic design of reinforced concrete and masonry buildings**. John Wiley & Sons. USA. 1992. ISBN 0-471-54915-0.
- Park, R., Gamble. **Reinforced concrete slabs**. John Wiley & Sons. New York. 1980.
- Federation International du Beton (FIB). **Structural concrete**. Lausanne. 1999.