Advanced Design of Concrete Structures (250473)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Civil i Ambiental (DECA)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012) MÀSTER UNIVERSITARI EN ENGINYERIA DE CAMINS, CANALS I PORTS (pla 2012) MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ (pla 2015) PARS: ENGINYER/A DE CAMINS, CANALS I PORTS (pla 2022)
Course	2024/25

Main teaching language at each group

- Group 10EN2 English (Q2)
- Group 10ES1 Spanish (Q1)

Faculty

Responsible Faculty: Juan Murcia Delso
Faculty: Jesús Miguel Bairán García, Alberto De La Fuente Antequera, Noemí Duarte Gómez, Juan Murcia Delso, Eva Maria Oller Ibars

Objectives of Education

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.

Competencies

Especific

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.

Transversal

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.
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.
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.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	25.5 h	56.67 %
	Medium group	9.75 h	21.67 %
	Laboratory classes	9.75 h	21.67 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

Contents

Method of struts and ties

Struts and ties
Struts and ties. Exercise

Structural Elements

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

Analysis of concrete structures

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

Limit States

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

Laboratory

Virtual analysis Lab and Tests at the LTE

Evaluation

Teaching Methodology

The course consists of 3 hours a week of face-to-face classes (or not, depending on the circumstances)

Approximately two hours of each class session is devoted to exposing the basic concepts of the subject and to present examples that help to consolidate the general and specific learning objectives. In addition, questions to be answered and exercises to be read/solved by the students will be proposed, that will be discussed and covered the following week.

Sufficient material will be provided to the students so that they can deep into the subject and answer the questions and understand/solved the proposed problems.

The remaining hour of each session will be devoted to solving students' doubts about the subject explained, the problems proposed and the questions asked the previous week.

The distribution of this time (2h + 1h) will depend on the subject and the availability of time, according to the development of the subject.

Support material in detailed teaching plan format is used through the ATENEA virtual campus: contents, programming of assessment and directed learning activities and bibliography.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

Grading Rules

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

The evaluation will be continued and will have two components: 1) the course work and 2) the final exam.

The course work will consist of a design or verification of a structure, of limited entity where the concepts discussed within the course are applied. The final exam will be done at the end of the course by means of questions and / or short conceptual problems, but which require demonstrating the ability to apply the fundamental concepts of the subject

A final grade equal to or greater than 5 is required to pass the course. Those students that do not pass the course with this evaluation system, will have right to an extraordinary exam.

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.

Office Hours

Prof. Juan Murcia: After class or by appointment. Office C1-203B.
Other professors of the course: by appointment.

Bibliography

Basic

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- Paulay, T.; Priestley, M.J.N. Seismic design of reinforced concrete and masonry buildings. New York: Wiley & Sons, 1992. ISBN 0471549150.
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