



Course guide

250440 - ENGCOMPRESX - Computational Engineering for Design and Operation

Last modified: 28/03/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Optional subject).
Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: NATIVITAT PASTOR TORRENTE
Others: NATIVITAT PASTOR TORRENTE, ANTONIO RODRIGUEZ FERRAN

TEACHING METHODOLOGY

Taught module delivery: thirteen weeks of teaching, coursework and self-study. Apart from the 3 hours per week in the classroom, self-study must last an average of 4.5 hours per week.

At least a half of the hours devoted to the course will be carried out in small work groups (computer laboratory, evaluations, etc.)

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.

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.

Tutored weekly class where case studies and practical examples are reproduced by the students. Topics in computational engineering are reviewed and worked in depth using commercial software

STUDY LOAD

Type	Hours	Percentage
Hours small group	9,8	7.83
Hours large group	25,5	20.38
Hours medium group	9,8	7.83
Self study	80,0	63.95

Total learning time: 125.1 h

CONTENTS

Introduction

Description:

Basic steps in computer modeling
Modeling exercise with pdetools. Error measures, convergence.

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

Theory classes: 2h

Laboratory classes: 1h

Self study : 4h 11m

Governing physics

Description:

Balance equations: solids, fluids. Thermal balance. Transport equation

Exercise on heat transfer.

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

Theory classes: 2h

Laboratory classes: 1h

Self study : 4h 11m

Discretization methods

Description:

Finite elements
Abaqus. SAP. Other commercial software.

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

Theory classes: 2h

Laboratory classes: 1h

Self study : 4h 11m

Linear Elasticity

Description:

Bulk and structural elements.
Introduction to SAP
Exercise with SAP

Full-or-part-time: 21h 36m

Theory classes: 1h

Laboratory classes: 8h

Self study : 12h 36m



Dynamics

Description:

Modal and direct time-integration algorithms, explicit, implicit, stability.
Introduction to Abaqus

Full-or-part-time: 12h

Theory classes: 2h

Laboratory classes: 3h

Self study : 7h

Evaluation

Full-or-part-time: 16h 48m

Laboratory classes: 7h

Self study : 9h 48m

Non-linearities

Description:

Non-linear elasticity. Plasticity. Viscoelasticity. Damage.
Exercise with Abaqus

Full-or-part-time: 14h 23m

Theory classes: 1h

Laboratory classes: 5h

Self study : 8h 23m

Buckling

Description:

Linear and non-linear Buckling
Exercise

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

Theory classes: 1h

Laboratory classes: 2h

Self study : 4h 11m

GRADING SYSTEM

The mark of the course is obtained as follows:

$$\text{Mark} = Q \cdot 0.2 + A \cdot 0.3 + P \cdot 0.5$$

where

Q is the mark of the in-class written exam

A is the average of the marks of the three assignments

P is the mark of the final project



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:

- Zienkiewicz, O.C.; Morgan, K. Finite elements and approximation. New York: John Wiley and Sons, 1983. ISBN 0471982407.

Complementary:

- Oliver Olivella, X.; Agelet de Saracíbar, C. Mecànica de medis continus per a enginyers [on line]. Barcelona: Edicions UPC, 2003 [Consultation: 29/04/2020]. Available on: <http://hdl.handle.net/2117/97013>. ISBN 8483017199.

- Bathe, K.-J. Finite element procedures. [S. l.]: l'autor, 2006. ISBN 9780979004902.

- Belytschko, T.; Liu, W.K.; Moran, B.; Elkhodary, K. Nonlinear finite elements for continua and structures [on line]. 2nd ed. Chichester: Wiley, 2014 [Consultation: 05/02/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1501634>. ISBN 9781118632703.