

# Computational Mechanics Tools (250961)

## General Information

<b>School</b>	ETSECCPB
<b>Departments</b>	Departament d'Enginyeria Civil i Ambiental (DECA)
<b>Credits</b>	5.0 ECTS
<b>Programs</b>	MÀSTER UNIVERSITARI EN MÈTODES NUMÈRICS EN ENGINYERIA (pla 2012) MÀSTER UNIVERSITARI EN MÈTODES NUMÈRICS EN ENGINYERIA (pla 2012)
<b>Course</b>	2025/26

## Main teaching language at each group

- Group 10Q1 English (Q1)

## Faculty

Responsible Faculty: Jose Sarrate Ramos

Faculty: Natividad Pastor Torrente, Denise Carina Santos Ferreira, Jose Sarrate Ramos

## Objectives of Education

This module is an introduction to solving engineering problems using commercial finite element packages (GiD, Abaqus and Diana). Therefore, it has a clearly practical orientation.

The learning objectives are:

- Know the mesh generation methods and understand their advantages and limitations.
- Be able to identify which type of method is most suitable for a particular case.
- Understand and identify the different causes of problems that a CAD model can present.
- Identify some of the tools available to correct CAD models and be able to use them to improve and heal the digital model.
- Generate finite element meshes from a CAD model using the computer packages available in the course.
- Understand and formulate the governing equations for a specific engineering problem (thermal, mechanical problem, ...).
- Predict the difficulties presented by this problem and formulate the appropriate algorithms to deal with them.
- Implement the resolution algorithms using commercial packages (Abaqus and Diana).
- Visualize the results obtained using the different visualization tools presented by these commercial packages.
- Analyze the obtained results.

## Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	45.0 h	100.00 %
	Medium group	0.0 h	0.00 %
	Laboratory classes	0.0 h	0.00 %
	Guided Activities	0.0 h	0.00 %
Self Study		80.0 h	

# Contents

## Introduction to mesh generation methods

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Introduction to the digital representation of geometric models  
Methods for the discretization of geometric models  
Quality and adaptation of meshes  
Mesh generation with GiD

## Specific Objectives

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## Engineering problem simulation with Diana

Introduction to Diana  
Problem solution with Diana  
Modeling with Diana

## Simulation of engineering problems with Abaqus

Introduction to Abaqus  
Solving problems with Abaqus  
Modeling with Abaqus

## Teaching Methodology

The subject consists of 3 hours per week of face-to-face classes in the classroom.

1.5 hours are dedicated to the exposition of the concepts and basic materials of the course, presentation of examples and carrying out exercises.

1.5 hours are dedicated to the resolution of problems and projects with greater interaction with the students. Practical exercises are carried out in order to consolidate the general and specific learning objectives.

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

## Grading Rules

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

The final mark for the module is obtained from the grades obtained in the assignments and projects completed during the course.

The final mark will be computed as

$$FM = 0.3 AS + 0.3 MP + 0.4 PC$$

where FM is the final mark, AS is the average of the grades corresponding to the assignments completed during the course, MP is the grade corresponding to the mesh generation project, and CP is the grade for the course project.

The assignments and the mesh generation project will be done individually while the course project will be done in groups of two students (except for justified situations).

## Test Rules

To pass the module it is mandatory to present all the assignments and projects.

Academic dishonesty (including, among others, plagiarism and falsification of results) will be severely punished, in accordance with current academic regulations: any such act will imply a final mark of 0 in the module.

## Office Hours

It will be announced at the beginning of the course.

## Bibliography

### Basic

- Thompson J.F., Soni B.K., and Weatherill N.P. [Handbook of Grid Generation](#). Boca Raton [etc.]: CRC press, 1999. ISBN 0849326877.
- Topping B.H.V ... [et al.]. [Finite Element Mesh Generation](#). Kippen: Saxe-Coburg Publications, 2004. ISBN 1874672105.
- Zienkiewicz, O.C.; Morgan. K. [Finite elements and approximation](#). Mineola, NY: Dover Publications, 1983. ISBN 0486453014.
- Piegl, Les; Tiller, Wayne. [The NURBS book](#). 2nd ed. Berlin; New York: Springer, 1997. ISBN 9783540615453.

### Complementary

- Faux D. and Pratt M.J. [Computational Geometry for Design and Manufacture](#). Chichester : New York [etc.]: Elli Horwood Publishers, 1981. ISBN 0470270691.