

## SUBJECT TEACHING GUIDE

M1434 - Numerical Simulation of Materials, Components and Structures

Master's Degree in Integrity and Durability of Materials, Components and Structures

Academic year 2022-2023

1. IDENTIFYING DATA					
Degree	Master's Degree in Integrity and Durability of Materials, Components and Structures			Type and Year	Compulsory. Year 1
Faculty	School of civil Engineering				
Discipline					
Course unit title and code	M1434 - Numerical Simulation of Materials, Components and Structures				
Number of ECTS credits allocated	4	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. CIENCIA E INGENIERIA DEL TERRENO Y DE LOS MATERIALES				
Name of lecturer	ROBERTO LACALLE CALDERON				
E-mail	roberto.lacalle@unican.es				
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 0. DESPACHO (0006)				
Other lecturers					

### 3.1 LEARNING OUTCOMES

- Knowledge of the fundamentals of the finite element method and basic management of commercial software

### 4. OBJECTIVES

Know the fundamentals of the finite element method

Solve mechanical, thermal and thermomechanical problems

Basic management of commercial finite element software.

## 6. COURSE ORGANIZATION

### CONTENTS

1	Introduction to the numerical simulation of materials, components and structures. The finite element method. FE programs today. Analysis stages: Pre-process, analysis and post-process. Simulation strategies. Creation of Macros and subroutines.
2	Numerical simulation of plasticity. Previous theoretical concepts. Numerical simulation in plasticity. Application Examples
3	Numerical simulation in linear elastic fracture mechanics. Previous theoretical concepts. Numerical simulation of the LEFM. Application Examples
4	Numerical simulation in elasto-plastic fracture mechanics. Previous theoretical concepts. Numerical simulation of the EPFM. Application examples
5	Simulation of fatigue crack propagation. Previous theoretical concepts. Numerical simulation of crack propagation. Macro development. Application Examples
6	Simulation of damage models. Previous theoretical concepts. damage models. Numerical simulation of damage models. Application Examples

## 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Description Final exam	Written exam	Yes	Yes	40,00
Description Practices	Work	No	Yes	40,00
Description Group work	Work	No	No	20,00
TOTAL				100,00
Observations				
Group works, given that they are carried out during the course, are classified as non-recoverable				
Observations for part-time students				
For part-time students, the evaluation of the practices will be replaced by the autonomous resolution of problems of similar difficulty and the subsequent delivery of a report with the problems solved				

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

### BASIC

- El método de los elementos finitos vol. I Las bases, Zienkiewicz, O.C. CIMNE.
- El método de los elementos finitos v. 2 Mecánica de sólidos, Zienkiewicz, O.C. CIMNE
- ANSYS User Manual, 2010
- Abaqus User Manual, 2011-11-28
- Oliver Olivella X., Agelet de Saracibar Bosch C.: "Mecánica de Medios Continuos para Ingenieros". Ediciones Universidad Politécnica de Cataluña. Barcelona, 2000.
- Anderson T.L. "Fracture Mechanics – Fundamental and Applications". CRC Press. 1995.
- Kanninen M. F. and Popelar C.H.: "Advanced Fracture Mechanics". Oxford Engineering Science Series 15. 1985.
- Broek D.: "Elementary Engineering Fracture Mechanics". Kluwer Academic Publishers. 1986.
- Vicente Sánchez Galvez: "Física de la Plasticidad". Servicio de Publicaciones de la E.T.S.I. de Caminos Canales y Puertos. Universidad Politécnica de Madrid, 2000.