

## SUBJECT TEACHING GUIDE

M1442 - Mathematical and Numerical Methods in Engineering

Master's Degree in Civil Engineering

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Master's Degree in Civil Engineering			Type and Year	Compulsory. Year 1
Faculty	School of civil Engineering				
Discipline	Mathematical and Computational Foundations of Engineering				
Course unit title and code	M1442 - Mathematical and Numerical Methods in Engineering				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web	<a href="http://personales.unican.es/gila/MetMatNum2019.pdf">http://personales.unican.es/gila/MetMatNum2019.pdf</a>				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION
Name of lecturer	AMPARO GIL GOMEZ
E-mail	amparo.gil@unican.es
Office	E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 1. DESPACHO PROFESORES (1028)
Other lecturers	PEDRO SERRANO BRAVO ALBERTO LUCEÑO VAZQUEZ MARIA EUGENIA PEREZ MARTINEZ JOAQUIN BEDIA JIMENEZ

### 3.1 LEARNING OUTCOMES

- To complete the training of the student in ordinary and partial differential both in the theoretical analysis involved and as a tool for modeling in science and engineering.
- Knowing and using the standard differential operators appearing in different problems in Engineering.
- Learning numerical techniques (finite differences, finite elements) involved in the solution of physical and engineering problems represented by partial differential equations.
- knowing and using statistical methods in multivariate regression models, which are applied in various fields of Civil Engineering, where random phenomena have to be considered.

#### 4. OBJECTIVES

To acquire ability to address and solve advanced mathematical engineering problems from the statement to the development of the formulation and implementation in a computer program.

Acquiring capacity to formulate and apply advanced analytical and numerical methods and models for engineering calculation, project planning and management.

To acquire abilities to interpret results in the context of Civil Engineering, Computational Mechanics and / or Mathematical Engineering, among others.

#### 6. COURSE ORGANIZATION

##### CONTENTS

1	Part I: Partial differential equations: introduction; analytical and computational methods. Applications to engineering problems. Basic ideas on differential operators and field theory.
2	Part II: Numerical methods for engineering field problems (heat, hydraulics, mechanics, ...). Finite elements. Finite differences. Implementation of computational schemes.
3	Part III: Multivariate statistical regression methods. Linear and nonlinear models. Engineering applications.

#### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Written exam with questions and exercises related to Parts I and II of the course.	Written exam	Yes	Yes	46,00
Written exam with questions and exercises related to Part III of the course.	Written exam	Yes	Yes	14,00
Class exercises, Parts I and II	Others	No	No	10,00
Computer Lab Evaluation. Parts I and II	Laboratory evaluation	No	No	14,00
Computer Lab Evaluation (Part III contents)	Laboratory evaluation	No	No	11,00
Attendance, participation, .... Parts I, II and III	Others	No	No	5,00
<b>TOTAL</b>				<b>100,00</b>

##### Observations

There will be a resitting examination for students having failed the ordinary written exams (Parts I, II and III).

##### Observations for part-time students

Class attendance (lectures, problems) is not mandatory, being the contents of the course available at the course web page. For part-time students, Parts I and II computer lab activities and their evaluation will be as for full-time students. Regarding Part 3, part-time students are allowed to submit electronically the computer lab reports.

#### 8. BIBLIOGRAPHY AND TEACHING MATERIALS

##### BASIC

Material puesto a disposición para clase (presentaciones, ejercicios, programas de ordenador).

Pérez, M.E. "Cálculo simbólico y numérico en ecuaciones diferenciales". OCW, UNICAN, Santander, 2014.

Fish, J., Belytschko, T. "A First Course in Finite Elements". Ed. John Wiley. 2007.

Luceño, A. "Métodos de Estadística Aplicada". Public. ETS de Ingenieros de Caminos. Santander. 1989.

