SUBJECT TEACHING GUIDE

G1963 - BROAD MATHEMATICS

Degree in Civil Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Civil Engineering			Type and Year	Core. Year 2
Faculty	School of civil Engineering				
Discipline	BASIC MATHEMATICS FOR ENGINEERING				
Course unit title and code	G1963 - BROAD MATHEMATICS				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web	https://personales.unican.es/meperez/				
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	MARIA EUGENIA PEREZ MARTINEZ
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Other lecturers	

3.1 LEARNING OUTCOMES
- Solving ordinary differential equations and differential systems which are of interest to address Engineering Models
- Solving partial differential equations which are are of interest to face Engineering Models
- Applying Series and Transforms to Engineering Models
- Setting / Analytical and Computational treatment of some differential models that appear in Science and Technology.

4. OBJECTIVES
1.- Introduction to the study of differential equations that appear in models from very different branches of Science and Technology, providing techniques for solving these equations and techniques for approximations to solutions.
2.- To provide capacities to approach and solve mathematical engineering problems: we go from from the setting of the problem to the development of the formulation and its computational treatment. Also, to promote the interpretation of the obtained results in the framework of Civil Engineering, Mechanics, Mathematical Engineering and/or ODS 6 and 11 in which they can contribute.
3.- Introduction to computational methods for solving differential equations. Computer simulation of some processes in differential models.

6. COURSE ORGANIZATION	
CONTENTS	
1	Block 1- ODE 1.-FIRST ORDER DIFFERENTIAL EQUATIONS. 1.1.-Introduction to solutions of some elementary differential equations. Qualitative behaviors. 1.2.- The Cauchy problem: existence and uniqueness of solution and its numerical approximation 1.3.- Differential models in Science and Technology (population growth, velocity problems)
2	Block 1- ODE 2.- SECOND ORDER DIFFERENTIAL EQUATIONS . 2.1.- Linear differential equations with variable coefficients. 2.2.-Linear differential equations with constant coefficients. 2.3. The Method of power series. Power series solutions of differential equations. 2.4.- The Cauchy problem. Numerical approximation of solutions. 2.5.- Differential models in Engineering (springs, oscilatory systems and related issues) .
3	Block II.- ODE and Systems of DE 3.- ORDINARY DIFFERENTIAL EQUATIONS of order n, with n> 1. 3.1.-Linear differential equations with constant coefficients. 3.2.- The method of the Laplace Transform: solving differential equations 3.3.- Differential models in Engineering (springs, beams, spetial functions). 4.- FIRST ORDER DIFFERENTIAL SYSTEMS with n equations, n>1. 3.1.- Linear differential systems: constant coefficients and variable coefficients. 3.2.- Nonlinear differential systems: numerical solutions.
4	Block III- PDE 5.- BOUNDARY VALUE PROBLEMS. 5.1.- Regular boundary value problems 5.2.- Eigenvalue problems 5.3.- Fourier series. 5.4.- Differential models in Engineering (beams, strings and related issues). 6. PARTIAL DIFFERENTIAL EQUATIONS: AN INTRODUCTION; ANALITICAL AND COMPUTATIONAL METHODS 6.1.- Some models in Science and Technology: the Laplace equation, the heat equation, and the wave equation. The transport equations. 6.2.- The method of separation of variables (two independent variables). Application of the Fourier series. 6.3.- Models for vibrating beams, strings and mebranes. Computer simulations.

7. ASSESSMENT METHODS AND CRITERIA				
Description	Type	Final Eval.	Reassessn	%
- A midterm exam: with a weight of 33% of the final mark. - It will be carried out during the weeks 9-10 of the semester. Lessons 1-3 of the program. - The minimum mark to compensate: 11 points about 33 points.	Written exam	No	Yes	33,00
- This exam has a weight of 33% over the final mark. - It will be carried out the day established by the School. Lessons 4-6 of the program. - The minimum mark to compensate: 11 points about 33 points.	Written exam	Yes	Yes	30,00
Exam (by groups) at the end of the practical classes (at the end of the semester), in the laboratory of informatics: it has a weight of 22% of the final mark. Only for students attending practical classes.	Laboratory evaluation	No	Yes	25,00
Continuous assessment of all the blocks and practical classes. Weight of 12% of the final mark .	Others	No	Yes	12,00
TOTAL				100,00

Observations

- Students having to make use of the recovery of any part of the subject can perform a global examination of the subject in the extraordinary convocatory established by the University / School. The final mark will be that obtained in this overall examination. Also, they can recover the different exams. In any case the evaluation of the practical classes block applies only to students who have attended these practical clases and this recovery will consist of the delivery and defense of a work (with the weight of 25%).

- In the case that you have the right to take the whole evaluation in November convocatory, it will consist of a theoretical-practical wirtten exam with the weight of 75%; the evaluation of the block of the laboratory practices will consist of the delivery and defense of a work and will have a weight of 25%.

- As regards any exam: after the exam, an individual oral defense may be requested.

- In the case of mixed teaching, or distance teaching, due to sanitary requirements (imposed by the healthcare authorities), continuous face-to-face or online assessment would be intensified. If the exams can be face-to-face, they would be maintained anyway, while in the extreme case of not being able to be face-to-face, a single distance examination would be done. This exam would consist of a theoretical-practical part, and another of laboratory practices, related to all the matter not evaluated in previous exams, and will be complemented with a face-to-face or online individual oral test.

Observations for part-time students

Part-time students may choose between the attendance to a global exam only (after applying), or the attendance to the midterm and final exams, practices and continuous assessment, with the same criteria and weights as the full-time students. Evaluation regime of practices is the same as full-time students: evaluation of this block only applies to students who have attended these classes and it represents 25% of the total mark.

In the case where you choose the global exam, the evaluation will consist of a theoretical-practical wirtten exam with the weight of 75%; the evaluation of the block of the laboratory practices will consist of the delivery and defense of a work and will have a weight of 25%.

The recovery regime will be the same as full-time students.

As regards any exam: after the exam, an individual oral defense may be requested.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

M. E. PÉREZ, "Ecuaciones Diferenciales: Una introducción". ETSI Caminos, Universidad de Cantabria, Santander, 1999. Sitio web: https://ocw.unican.es/pluginfile.php/1922/course/section/1611/Libro-curso.pdf

M. E. PÉREZ, "Cálculo simbólico y numérico en Ecuaciones Diferenciales", OCW, Universidad de Cantabria, Santander, 2014. Sitio web: https://ocw.unican.es/course/view.php?id=169

W. E. BOYCE and R. C. DIPRIMA. “Elementary Differential Equations and Boundary Value Problems”. John Wiley and Sons. 1986. (Cuarta o Quinta Edición, también ediciones en castellano).

R. KENT NAGLE and E. B. SAFF. “Fundamentos de Ecuaciones Diferenciales”. Addison-Wesley Iberoamericana. 1992. (Segunda o Tercera Edición, o posteriores en castellano o en inglés, o ediciones por los autores con A. D. SNIDER).

G.F. SIMMONS. “Ecuaciones Diferenciales”. McGraw¬Hill. 1993. (Segunda edición o posteriores, o ediciones por el autor y S.G. KRANTZ).

M.E. PÉREZ. Esquemas y Complementos de curso, en página web: https://personales.unican.es/meperez/