SUBJECT TEACHING GUIDE

M1510 - Partial Derived Equations in Engineering Science

Master's Degree in Mathematics and Computing

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Master's Degree in Mathematics and Computing			Type and Year	Optional. Year 1
Faculty	Faculty of Sciences				
Discipline					
Course unit title and code	M1510 - Partial Derived Equations in Engineering Science				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	DIANA STAN
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Other lecturers	RAFAEL GRANERO BELINCHON

3.1 LEARNING OUTCOMES
- Recognizing different types of partial differential equations.
- Determine explicit solutions of some linear and non-linear PDEs.
- Solving Cauchy and boundary value problems for some parabolic/hyperbolic PDE.
- Deduction of the PDE describing certain physical phenomena.

4. OBJECTIVES

This course is aimed for master students with basic knowledge of the theory of differential equations and will focus on the advanced development of the theory of parabolic and hyperbolic equations, with the possible extension of the methods to other equations. The main objectives that are pursued with this course are that students become familiar with a wide class of techniques and results of the classical and recent theory.

The objectives are framed within the applications of Mathematical Analysis to the natural sciences. The double dependence on the space-time variables establish the PDE as a paradigm of the deterministic mathematical formulations of physical and biological processes, among others.

6. COURSE ORGANIZATION

CONTENTS	
1	The Cauchy problem for the heat equation: fundamental solution, energy estimates, asymptotic behavior for large times, heat equation with reaction effects.
2	The Cauchy problem for the heat equation: fundamental solution, energy estimates, asymptotic behavior for large times, heat equation with reaction effects.
3	The Porous Medium Equation: construction of the fundamental solution and study of the Cauchy problem.
4	The Euler equations for incompressible fluids. The vorticity equation, Beale-Kato-Majda criterion, the problem of the vorticity patch.
5	Active scalars: the quasi-geostrophic equation and the incompressible porous medium equation.
6	Free boundary problems. Muskat problem and the problem of water waves.
7	Evaluation: presentation of a project.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Evaluation method: Project.	Work	Yes	Yes	100,00
TOTAL				100,00
Observations				
Observations for part-time students				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

L. Evans, Partial Differential Equations, Graduate studies in mathematics, 1998

A. Majda, A. Bertozzi, Vorticity and incompressible flow. Cambridge Texts in Applied Mathematics, 27. Cambridge University Press, Cambridge, 2002