SUBJECT TEACHING GUIDE

349 - Partial Derived Equations in Engineering Science

Master's Degree in Mathematics and Computing

Academic year 2023-2024

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	349 - Partial Derived Equations in Engineering Science				
Number of ECTS credits allocated	3	Term		Semester based (2)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICAS, ESTADISTICA Y COMPUTACION
Name of lecturer	DIANA STAN
E-mail	diana.stan@unican.es
Office	Facultad de Ciencias. Planta: + 3. DESPACHO DIANA STAN (3004)
Other lecturers	RAFAEL GRANERO BELINCHON DANIEL LEAR CLAVERAS

3.1 LEARNING OUTCOMES
- Theoretical study of the well-posedness of linear and nonlinear elliptic equations
- Knowledge on Lax-Milgram Lemma and several fixed point theorems. Knowledge on the direct method of the calculus of variations
- Theretical study of the well-posedness for linear and non-linear evolutionary PDE.
- Knowledge on the Garlekin method and on several fixed point theorems. Aplication of Lax-milgram Lemma to evolutionary PDE.
- Mathematical modelling of physical phenomena using PDEs

4. OBJECTIVES

This course is aimed for master students with basic knowledge of the theory of differential equations and will focus on the advanced developments 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	Sobolev spaces: properties and applications to the study of PDEs
2	Elliptic equations. Wean and strong solutions. Lax-Milgram Lemma and fixed point theorems. Properties of the solutions: mean value property, maximum principle and Harnack's inequality. Direct method of the calculus of variations.
3	Evolutionary PDE. Weak and strong solutions. Application of Lax-Milgram Lemma to evolutionary PDE. Banach fixed point theorem and applications to PDE. Galerkin method.
4	Properties of the solutions to evolutionary PDE. Entropy method and convergence to equilibrium.
5	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

Students will have to realize a project on a topic proposed by the professors of this course. The presentation of the work will take place in the classroom if the sanitary measures allow it or in a virtual way otherwise.

Observations for part-time students

Part-time students will be evaluated the same way as the other students.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Lawrence Evans, "Partial Differential Equations", Graduate Studies in Mathematics, 1998

Haim Brezis, "Functional Analysis, Sobolev Spaces and Partial Differential Equations", Springer.

Apuntes facilitados por el profesor Rafael Granero