SUBJECT TEACHING GUIDE

G60 - Mathematical Methods II: Partial Differential Equations

Degree in Physics

Academic year 2020-2021

1. IDENTIFYING DATA					
Degree	Degree in Physics			Type and Year	Compulsory. Year 2
Faculty	Faculty of Sciences				
Discipline	Subject Area: Advanced Mathematics for Science Central Module				
Course unit title and code	G60 - Mathematical Methods II: Partial Differential Equations				
Number of ECTS credits allocated	6	Term		Semester based (2)	
Web	http://personales.unican.es/graneror/index.html				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

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

3.1 LEARNING OUTCOMES

- 1) To use analytical or approximate methods to solve partial differential equations (PDE), including Wave, Heat and Laplace equations.
2) To apply the representation of simple functions in Fourier series for solving PDE.
3) To know and manage the Fourier and Laplace transforms, as well as its main properties to solve differential equations.
4) To know and use the main properties of the most used special functions in Physics and its relation with solving PDE.
5) To use the elementary theory of distributions
6) To know some basic numerical methods to approximate solutions of PDE

4. OBJECTIVES

1) To know and distinguish the most important types of mathematical problems that arise in Physics and Engineering (ODE, PDE, linear, nonlinear, initial value problems, boundary value problems, ...).

2) To know and use the most common mathematical techniques in Physics and Engineering , depending on the type of problem to be solved.

3) To understand the equivalence between various mathematical problems

6. COURSE ORGANIZATION

CONTENTS	
1	Introduction to partial differential equations (PDE). First order linear PDE. Characteristic curves. Heat, Wave and Laplace equations. Elementary solving method.
2	Method of separation of variables. Application to find solutions of PDE: Heat conduction in a rod, vibrations of a string and Laplace equation in a rectangle. Fourier series in terms of complex exponentials. Pointwise convergence, uniform convergence, L^2 convergence. Fourier series in terms of trigonometric functions. Orthogonal polynomials and Bessel functions. Series in terms of Legendre polynomials and Bessel functions.
3	Integral transforms of functions. Fourier transform. Laplace transform. Inverse transforms. Basic properties. Convolution of functions. Application to solving ODE and PDE. Elemental theory of distributions. Dirac delta. Weak derivatives of piecewise continuous functions.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Short questions and problems during the course.	Others	No	Yes	20,00
Final exam	Written exam	Yes	Yes	60,00
Quizes during the course.	Activity evaluation with Virtual Media	No	Yes	20,00
TOTAL				100,00

Observations

During the final exams the students will have to opportunity to improve their grade in the quizes and questions. Any material is forbbiden during the exams.

Observations for part-time students

Part time students can either follow the regular evaluation process or have a unique exam

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

1) Apuntes de la asignatura facilitados por el profesor

2) Partial Differential Equations: An Introduction 2nd Edition, Walter A. Strauss, John Wiley & sons, 2008

3) Apuntes, L. A. Fernández, Univ. de Cantabria, 2014.

4) Methods of Mathematical Physics, Courant y Hilbert, Ed. Wiley Interscience.