Partial differential equations

Academic Year: (2021 / 2022) **Review date: 29-06-2021**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PABLO MARTINEZ, ARTURO DE

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Besides the Basic Core matters: Vector calculus (year 1, semester 2), Integration and measure (year 2, semester 1), Ordinary differential equations (year 3, semester 1).

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to PDEs. First concepts. Fundamental equations.
2. Fourier series. Motivation. Convergence and regularity of Fourier series. Sturm-Liouville problems. Generalized Fourier series. The Fourier transform.
3. Elliptic equations. Laplace equation. Properties of harmonic functions. Poisson equation . Green representation. Green function in different domains. Eigenvalue problem.
4. Parabolic equations. Heat equation in bounded domains. Green representation. Heat equation in the whole space. Gauss kernel. Selfsimilarity.
5. Hyperbolic equations. Wave equation in bounded domains. Resonance. Green representation. Wave equation in the line. D'Alembert formula. Wave propagation in dimensions 3 and 2, Green function. Huygens principle.

LEARNING ACTIVITIES AND METHODOLOGY

THEORETICAL-PRACTICAL CLASSES. [44 hours with 100% classroom instruction, 1.76 ECTS]
Knowledge and concepts students must acquire. Student receive course notes and will have basic reference texts to facilitate following the classes and carrying out follow up work. Students partake in exercises to resolve practical problems and participate in workshops and evaluation tests, all geared towards acquiring the necessary capabilities.
TUTORING SESSIONS. [4 hours of tutoring with 100% on-site attendance, 0.16 ECTS]
Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher.
STUDENT INDIVIDUAL WORK OR GROUP WORK [98 hours with 0 % on-site, 3.92 ECTS]
FINAL EXAM. [4 hours with 100% on site, 0.16 ECTS]
Global assessment of knowledge, skills and capacities acquired throughout the course.
METHODOLOGIES
THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject`s main concepts are developed, while providing material and bibliography to complement student learning.
PRACTICAL CLASS. Resolution of practical cases and problems, posed by the teacher, and carried out individually or in a group.
TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with a teacher as tutor.

ASSESSMENT SYSTEM

SE1 - FINAL EXAM. [60 %]
Global assessment of knowledge, skills and capacities acquired throughout the course.
SE2 - CONTINUOUS EVALUATION. [40 %]
Assesses papers, projects, class presentations, debates, exercises, internships and workshops throughout the course.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Harry Dym, Henry P. MacKean Fourier series and integrals, Academic Press , 1972

- Richard Courant, David Hilbert Methods of mathematical physics, John Wiley & Sons, 1989

- Richard Haberman Elementary applied partial differential equations : with Fourier series and boundary value problems, Prentice Hall, 1998

ADDITIONAL BIBLIOGRAPHY

- A.N. Tijonov Ecuaciones de la física matemática, URSS, 1980

- E. Zauderer Partial differential equations of applied mathematics, Wiley, 2006

- F. John Partial differential equations, Springer Verlag, 1980

- F. Treves Basic linear partial differential equations, Academic Press, 1975

- G.F. Pearson, C.E. Carrier Partial differential equations : theory and technique, Academic Press, 1988

- I. Peral Primer curso de ecuaciones en derivadas parciales, Addison Wesley UAM, 1995

- J. Kevorkian Partial differential equations, Texts in applied math., 2000

- L.C. Evans Partial differential equations, AMS, 2010

- P. Garabedian Partial differential equations, AMS, 1998

- R.V. Churchil Series de Fourier y problemas de contorno, McGraww-Hill, 1966

- S.K. Godunov Ecuaciones de la física matemática, Mir, 1978