Partial Differential Equations

ECTS: 6 ECTS

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UNIVERSITY WHERE THE COORDINATOR IS: UVigo

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

LECTURER 1: Fernando Varas Mérida (fernando.varas@upm.es)

UNIVERSITY WHERE THE LECTURER 1 IS: UPM

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

SUBJECT CONTENTS

Part 1. Classical analysis of partial differential equations.

1.1. Introduction to partial differential equations: some outstanding examples, first order examples and characteristic curves, and introduction to Fourier analysis.

1.2. Laplace and Poisson equations: qualitative properties and solution analytical techniques.

1.3. Heat equation: qualitative properties and solution analytical techniques.

1.4. Wave equation: qualitative properties and solution analytical techniques.

Part 2. Variational analysis of partial differential equations.

2.1. Variational formulation of elliptic problems, linear elasticity and Stokes system.

2.2. Introduction to the variational formulation of evolutionary problems: parabolic and hyperbolic problems

METHODOLOGY

1) Master sessions: the contents of the subject will be given in these sessions.

2) Formulation, analysis and resolution of problems and exercises related to the subject.

Classes via videoconferencing system.

LANGUAGE USED IN CLASS: Spanish

IS IT COMPULSORY TO ATTEND CLASS? Students can attend via conference system.

BIBLIOGRAPHY

BASIC REFERENCES:

R. Haberman, Ecuaciones en Derivadas Parciales (con Series de Fourier y Problemas de contorno) 3a ed. Pearson Educación, 2003.

P.J. Olver, Introduction to Partial Differential Equations. Springer, 2014

P.A. Raviart, J.M. Thomas, Introduction a l'analyse numerique des equations aux derivees partielles. Masson, 1998.

R.E. Showalter, Monotone Operators in Banach Space and Nonlinear Partial Differential Equations. Mathematical Surveys and Monographs Volume 49. American Mathematical Society (AMS), 1997. (Chapter I & II)

COMPLEMENTARY REFERENCES:

H. Brezis, Analyse fonctionelle. Masson, 1983.

E. Casas, Introducción a las ecuaciones en derivadas parciales. Univ. Cantabria, 1992.

E. di Benedetto, Partial differential equations. Birkhauser, 2ª ed., 2010.

D. Gilbarg, N.S. Trudinger, Elliptic partial differential equations of second order. Springer, 1998.

J.L. Lions, Quelques methodes de resolution des problemes aux limites non lineaires. Dunod, 1969.

V.P. Mijailov, Ecuaciones diferenciales en derivadas parciales. MIR-Moscú, 2ª ed., 1982.

J. Necas, Direct methods in the theory of elliptic equations. Masson, 2012.

I. Peral, Primer curso de ecuaciones en derivadas parciales. Addison-Wesley. Univ. Autónoma Madrid, 1995.

R. Temam, Navier-Stokes equations. North-Holland, 1984.

SKILLS

Basic:

CG1: To have knowledge that provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context, knowing how to translate industrial needs in terms of R & D in the field of mathematics Industrial.

The General Methodology described above will enable to build this skill through the solution and presentation of several practical assignements proposed along the course;

Assessment of this skill is done according to the criteria described below (in the section related to grading)

CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way.

The General Methodology described above will enable to build this skill through the solution and presentation of several practical assignements proposed along the course;

Assessment of this skill is done according to the criteria described below (in the section related to grading);

CG5: To have the appropriate learning skills to enable them to continue studying in a way that will be largely self-directed or autonomous, and also to be able to successfully undertake doctoral studies.

The General Methodology described above will enable to build this skill through the solution and presentation of several practical assignements proposed along the course;

Assessment of this skill is done according to the criteria described below (in the section related to grading)

Specific:

CE3: To determine if a model of a process is well made and well mathematically formulated from a physical standpoint.

The General Methodology described above will enable to build this skill through the rigorous analysis of partial differential equations modelling several phisical phenomena;

Assessment of this skill is done according to the criteria described below (in the section related to grading)

Modelling specialization:

CM1: To be able to extract, using different analytical techniques, both qualitative and quantitative models.

The General Methodology described above will enable to build this skill through the rigorous mathematical analysis using analytical techniques to partial differential equations modelling several phisical phenomena;

Assessment of this skill is done according to the criteria described below (in the section related to grading)

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

The assesment will take into account:

1) individual exercises that will result in 60% of the grade.

2) a test that will result in 40% of the grade.

50% of the grade (both in individual assignments and final exams) will correspond to each part of the course (corresponding to classical and variational analysis, as described in the contents section). To pass this course a minimal grade of 3/10 (once weighting of individual assignments and final exams has been applied) must be obtained in each one of these parts.

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Same as the 1st assessment opportunity.