

Ordinary differential equations

Academic Year: (2020 / 2021)

Review date: 04-07-2020

Department assigned to the subject: Mathematics Department

Coordinating teacher: ALVAREZ CAUDEVILLA, PABLO

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Differential and Integral Calculus, Linear Algebra and Linear Geometry

OBJECTIVES

- To map real problems with their mathematical models in terms of differential equations.
- To solve differential equations through elementary integration methods as, for instance, power series, variable separation, etc.
- To make use of basic qualitative results on the existence, uniqueness, prolongation, and stability of solutions, etc.
- To analyze autonomous systems in the plane through phase portraits and identification of critical points.
- Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
- Students can synthesize conclusions obtained from analysis of mathematical models coming from real world applications and they can communicate in verbal and written form in English language, in an clear and convincing way and with a language that is accessible to the general public.
- Students can search and use bibliographic resources, in physical or digital support, as they are needed to state and solve mathematically and computationally applied problems arising in new or unknown environments or with insufficient information.
- Students have shown that they know and understand the mathematical language and abstract-rigorous reasoning as well as to apply them to state and prove precise results in several areas in mathematics.
- Students have shown that they understand the fundamental results from the theory of ordinary differential equations.
- Students are able to construct mathematical models of both discrete and continuous processes that appear in real world applications emphasizing the use of deterministic and stochastic difference and differential equations.
- To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them;

DESCRIPTION OF CONTENTS: PROGRAMME

1. Origins of ODEs in the applications
2. First order equations
3. Linear second order equations, higher order and linear differential systems
4. Existence, uniqueness and continuation of solutions
5. Resolution of ODEs with power series.
6. Nonlinear equations. Autonomous systems, phase plane, classification of critical points and stability theorems

LEARNING ACTIVITIES AND METHODOLOGY

- 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 problem, 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 teacher as tutor. Subjects with 6 credits have 4 hours of

tutoring/100% on-site.

ASSESSMENT SYSTEM

- FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course (60%).
- CONTINUOUS EVALUATION. 2 or 3 Mid-Term Exams (40%).

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

BASIC BIBLIOGRAPHY

- Earl A. Coddington An Introduction to Ordinary Differential Equations, Courier Corporation, 2012
- James C. Robinson An introduction to Ordinary Differential Equations, Cambridge University Press, 2004
- Steven G. Krantz Differential Equations. Theory, Technique and practice, CRC Press, 2015
- V. I. Arnold Ordinary Differential Equations, Springer, 1984

ADDITIONAL BIBLIOGRAPHY

- D. K. Arrowsmith, C. M. Place Ordinary Differential Equations, Chapman and Hall Mathematics Series, 1990
- George F. Carrier, Carl E. Pearson Ordinary Differential Equations, SIAM, 1968
- Herman Feshbach, Philip M. Morse Methods of Theoretical Physics, Mc Graw Hill, 1953
- J. Hale, H. Koçak Dynamics and Bifurcations, Springer-Verlag, 1991
- R. Kent Nagle, Edward B. Saff, Arthur David Snider Fundamentals of Differential Equations and Boundary Value Problems, Pearson, 2018
- Robert Mattheij, Jaap Molenaar Ordinary Differential Equations in Theory and Practice, SIAM, 2002