

## Ordinary differential equations

Academic Year: ( 2022 / 2023 )

Review date: 07-09-2022

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)

Linear Algebra (First course, first semester)  
 Differential Calculus (First course, first semester)  
 Integral Calculus (First course, second semester)  
 Linear Geometry (First course, second semester)

## 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

THEORETICAL-PRACTICAL CLASSES. [44 hours with 100% classroom instruction, 1.67 ECTS]

Knowledge and concepts students must acquire. Student will take notes during the lessons and will have basic reference texts to facilitate following the classes and carrying out follow up work. Students will get involved in solving exercises and practical problems. Also they will develop projects related to the different topics and take evaluation tests, all geared towards acquiring the necessary capabilities.

TUTORING SESSIONS. [4 hours of tutoring with 100% on-site attendance, 0.15 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, 3.72 ECTS]

WORKSHOPS AND LABORATORY SESSIONS [8 hours with 100% on site, 0.3 ECTS]

FINAL EXAM. [4 hours with 100% on site, 0.15 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, if necessary, 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 a teacher as tutor.

LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

## ASSESSMENT SYSTEM

SE1 - FINAL EXAM. [50 %]

Global assessment of knowledge, skills and capacities acquired throughout the course.

SE2 - CONTINUOUS EVALUATION. [50 %]

Assesses papers, projects, class presentations and workshops throughout the course.

**% end-of-term-examination:** 50

**% of continuous assessment (assignments, laboratory, practicals...):** 50

## 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