COURSE DATA

DATA SUBJECT

Code: 34170
Name: Ordinary differential equations
Cycle: Undergraduate Studies
ECTS Credits: 9
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Facultat de Ciències Matemàtiques	2	Second quarter
1935 - Double Degree Program in Mathematics-Telematics Engineering	Facultat de Ciències Matemàtiques	2	Second quarter
1936 - Double Degree Program in Mathematics-Telematics Engineering	Facultat de Ciències Matemàtiques	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1107 - Degree in Mathematics	Differential equations	COMPULSORY
1935 - Double Degree Program in Mathematics-Telematics Engineering	Segundo curso	COMPULSORY
1936 - Double Degree Program in Mathematics-Telematics Engineering	Segundo curso	COMPULSORY

COORDINATION

LOPEZ UREÑA SERGIO

ZORIO VENTURA DAVID

DONAT BENEITO ROSA MARIA

SUMMARY

The student will be introduced to the basic concepts of ODE, starting from the Cauchy problem. Analytical resolution methods will be studied and, in particular, the resolution of linear differential equations and systems. Examples of application in science will be proposed. Numerical methods for approximating solutions will be briefly introduced.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Relationship with other subjects of the same degree: No enrollment restrictions have been specified with other subjects in the curriculum.

The basic notions necessary to begin this subject will have been studied in the previous sub-jects of Mathematical Analysis I, Linear Algebra and Geometry I, and Cumputational Tools.

COMPETENCES / LEARNING OUTCOMES

1107 - Degree in Mathematics

Ability to work in teams.

Adapting to new situations.

Capacity for analysis and synthesis.

Capacity for criticism.

Capacity for organization and planning.

Capacity of abstraction and modeling.

Expressing mathematically in a rigorous and clear manner.

Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

Learn autonomously.

Possess and understand the mathematical knowledge.

Reason logically and identify errors in the procedures.

Solve problems that require the use of mathematical tools.

Visualize and interpret the solutions obtained.

DESCRIPTION OF CONTENTS

1. Introduction: Fundamentals and elementary methods

- Introduction to ODEs.
- First-order scalar linear ODEs.
- Separable variable ODEs.
- Cauchy problem and initial values problem.
- Relationship between family of curves and ODEs. Exact EDOs.

Practice topic 1:
Domains and analysis of solutions, identification of types of EDOs and search for solutions.

2. Existence, uniqueness, prolongability and dependence on initial conditions.

- Theorem(s) of existence and uniqueness: preliminaries and techniques.
- Extension of solutions
- Dependence on initial conditions.

Practice topic 2:
Uniform convergence of functions, applications of theory theorems

3. Elementary numerical methods.

- Euler's method: intuition and convergence

Practice topic 3:
Approximation of solutions on the computer and applications

4. First-order ODE systems.

- Formulation. Solutions and spaces of vector functions.
- Existence and uniqueness theorems for systems.
- ODEs of order n>1. Equivalence with first order linear systems.

Practice topic 4:
- Reduction of ODEs to first order, autonomous scalar second order ODEs, uniform convergence of vector functions.

5. Linear ODEs of order 2.

- Structure of the solution space.

- Theorems of existence and uniqueness.
- Second order ODEs with constant coefficients.
- Contour problem.

Practice topic 5:
- Linear scalar second order ODEs. Exact solutions on the computer.

6. Linear ODE systems.

- Structure of the solution space.
- Theorems of existence and uniqueness.
- Linear systems with constant coefficients.

Practice topic 6:
- Linear ODE systems. Exact solutions on the computer.

7. Autonomous systems, phase space and equilibrium points.

- Autonomous systems.
- Phase space.
- Balance points and their stability.

Practice topic 7:
- Qualitative analysis of autonomous systems.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	45,00
Other activities	11,00
Computer classroom practice	15,00
Classroom practices	19,00
Total hours	**90,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	6,00
Independent study and work	0,00
Preparation of lessons	79,00
Preparation for assessment activities	50,00
Resolution of case studies	0,00
Total hours	**135,00**

TEACHING METHODOLOGY

The development of the subject is structured around three axes: theory sessions, practical classes and tutorials and seminars.

Regarding the former, the teacher will develop the main points of the syllabus, using the classroom computer when it is necessary to illustrate a specific point. The student must attend to the scheduled class preparation time for optimal use.

The practical classes will help the student verify the degree of knowledge acquired, facing relatively complex problems and analyzing the results obtained. As before, the student must prepare these sessions to be able to perform the exercises in the scheduled time.

EVALUATION

The evaluation of the learning of the knowledge and skills achieved by the students will be done continuously throughout the course and will consist of the following two elements:

- Written or oral exams, which will represent 80% of the final grade. A minimum score of 3.5 out of 10 on each exam will be necessary to be able to average it with the other scores.
- Completion of work or exercises proposed by the teacher, all of which will represent 10% of the final grade.
- Participation in tutorials and seminars, activities that will account for 10% of the final grade.

REFERENCES

- Braun, M. Ecuaciones Diferenciales y sus aplicaciones. Grupo Editorial Iberoamérica. 1990.
- Ecuaciones Diferenciales con Aplicaciones y Notas Históricas, F. Simmons. Mc Graw Hill.
- Introduction to Differential Equations with Applications, F. Brauer, J.A. Nohel. Harper & Row Publishers, New York.
- Boyce, E. W., DiPrima, R.C. Elementary differential equations and Boundary value problems. John Wiley & sons, Inc. 1992.