

## Ordinary Differential Equations

Code: 104397  
ECTS Credits: 6

**2025/2026**

Degree	Type	Year
Computational Mathematics and Data Analytics	OB	2

### Contact

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### Teaching groups languages

You can view this information at the [end](#) of this document.

### Prerequisites

It is very convenient for the student to have achieved a good knowledge of the contents in Calculus in one variable, Linear algebra and Numerical analysis of the first course.

### Objectives and Contextualisation

The objective of the subject is to present differential equations as a quantitative and qualitative deterministic modeling tool for many processes of physics, chemistry, biology, etc. Also, the study of the solutions of these differential equations when they can be obtained in a closed form, when qualitative analysis is convenient and when approximate numerical computation turns out to be indispensable.

### Learning Outcomes

1. KM10 (Knowledge) Describe the mathematical concepts and objects of differential equations and numerical methods.
2. KM11 (Knowledge) Devise demonstrations of mathematical results of numerical calculus and numerical integration of ordinary differential equations and partial differential equations.
3. SM11 (Skill) Numerically integrate ordinary differential equations and partial differential equations.

### Content

1. Differential equations as a modeling tool. The initial value problem. Existence and uniqueness of solutions, dependence on initial conditions and parameters.
2. Scalar differential equations. Autonomous differential equations. Asymptotic behavior. Examples and applications to material balances and population dynamics.
3. Systems of linear differential equations and higher-order linear differential equations. Phase portraits of linear differential equation systems. Linear oscillations and periodic behavior.

4. Systems of nonlinear differential equations. Lyapunov stability. Linearization. Phase portraits in the plane. Applications to mechanics, ecology, and chemical kinetics.

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory classes	27	1.08	KM10, KM11, KM10
Type: Supervised			
Practical classes	12	0.48	KM11, SM11, KM11
Seminars	10	0.4	KM11, SM11, KM11
Type: Autonomous			
Personal study, theoretical and practical.	95	3.8	KM10, KM11, SM11, KM10

The course includes two hours of theory class per week. During seminar and practical sessions, students will solve exercises proposed by the instructor, who may provide guidance for their resolution. Part of the practical sessions will be devoted to the approximate computation of solutions. It is therefore essential that students have access to the software recommended by the teaching staff throughout the course. All materials and information related to the course will be provided on the course's Virtual Campus.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

## Assessment

### Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final exam	50%	3	0.12	KM10, KM11
Partial exam	40%	3	0.12	KM10, KM11
Seminars evaluation	10%	0	0	KM10, KM11, SM11

See the Catalan version.

## Bibliography

Borrelli, R., Coleman C.S. *Ecuaciones diferenciales. Una perspectiva de modelación*. Oxford University Press (2002)

Lynch, Stephen *Dynamical Systems with applications using Python*. Birkhauser, 2018

Martínez, R. *Models amb Equacions Diferencials*, Materials de la UAB no. 149. Bellaterra, 2004

Noonburg, V. W. *Differential Equations: From Calculus to Dynamical Systems*. AMS, 2019 [Recurs electrònic]

Zill, Dennis G. *A First Course in Differential Equations with Modeling Applications*, International Metric Edition, 2017 [Recurs electrònic]

## Software

There are no software requirements. The student will be able to use what he knows, in particular algebraic manipulation tools such as Maxima, Sage, Maple, etc., as well as numerical computation languages such as C. The use of one of the symbolic manipulators of open source could be mandatory.

## Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed