

**COURSE DATA****DATA SUBJECT****Code:** 33075**Name:** Mathematics I**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2025-26**STUDY (S)**

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Facultat de Ciències Biològiques	1	First quarter

**SUBJECT-MATTER**

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	Mathematics I	BASIC

**COORDINATION**

ROCHERA PLATA DAVID

**SUMMARY**

The course Mathematics I is part of the basic scientific training that every environmental science student must acquire before entering fully into the specifics of the degree.

On the one hand, the subject must fill in the gaps in mathematical knowledge gaps of many students who have entered university without studying mathematics at second course of high school. Corresponding to this aspect, the course begins with an introduction in which operations with numbers and vectors, elementary functions (including trigonometric functions and taking the opportunity to review trigonometry), function graphs and their interpretation, etc. are remembered.

On the other hand, the subject must provide the basic mathematical knowledge for any experimental science: a) differential and integral calculus, necessary to understand how mathematics is involved in issues related to velocity, slope, the determination of maxima and minima, and the measurement of areas...; b) an introduction to differential equations, with more emphasis on their concept and the meaning of solutions than on resolution methods, on the one side because this is of most interest to users who are not going to be professional mathematicians and, on the other side, because time does not permit to go far away; c) an introduction to numerical calculation methods, since most of the mathematical problems they will



find do not have exact solutions and these methods must be used, with the help of computer programs.

## PREVIOUS KNOWLEDGE

### RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

### OTHER REQUIREMENTS

## COMPETENCES / LEARNING OUTCOMES

-

Adquirir destrezas mínimas de cálculo diferencial e integral.

Reconocer cuestiones matemáticas y su tipo en problemas de medio ambiente.

Uso de herramientas matemáticas para la resolución de problemas relacionados con el medio ambiente.

## DESCRIPTION OF CONTENTS

### 1. Introduction

Chap 1. The plane  $\mathbb{R}^2$  and the space  $\mathbb{R}^3$ .

Vectors. Equation of a line in the plane. Slope of a line. Distance in the plane and in the space.

Chap. 2. Functions.

Graph of a function. Inverse of a function. Review of elementary functions. Exponential, logarithmic and polynomial growth. Equations. Graphical solution of equations. Limits of sequences and functions. Continuous functions and their graphs.

### 2. Differential and Integral Calculus

Chap. 3. The derivative.



3.1. The derivative of a function as a speed. 3.2. Calculation of derivatives. 3.3. The chain rule. 3.4. Contour lines. Derivative of functions defined implicitly. 3.5. The derivative of a function as the slope of its graph. 3.6. Numerical methods of solving equations based on the use of the derivative.

Chap. 4. Optimization.

4.1. Critical points for functions of one variable. 4.2. Absolute maxima and minima. 4.3. Local maxima and minim. 4.4. Concavity and convexity. 4.5. Interpretation and drawing of graphs.

Chap. 5. The integral for functions of one variable

5.1. Primitives or antiderivatives. 5.2. The primitives as solutions of differential equations. 5.3. Some integration methods.

Chap. 6. The definite integral.

6.1. Definition of a definite integral. 6.2. Relationship with the primitive. Barrow's rule. 6.3. Applications of integral calculus to the calculation of areas. 6.4. Methods for numerical integration.

### 3. Differential Equations

Chap 7. Ordinary differential equations of first order.

7.1. Background. Constant dependence. Initial conditions. 7.2. Differential Equations of first order. Graphical view in the plane. 7.3. Explicit solutions of some simpler first-order differential equations. 7.4. Numerical solutions of differential equations of first order.

Chap. 8. Some differential equations in Biology and in Environment.

8.1. Equilibrium and stability. 8.2. Exponential growth of a population. Restricted growth. Logistic equation. 8.3. Allometric growth. 8.4. Homeostasis. 8.5. Dynamic balance of matter or energy.

## WORKLOAD

### PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	3,00



Theory	45,00
Computer classroom practice	12,00
<b>Total hours</b>	<b>60,00</b>

### NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	14,00
Independent study and work	0,00
Preparation of lessons	63,00
Preparation for assessment activities	13,00
Resolution of case studies	0,00
<b>Total hours</b>	<b>90,00</b>

### TEACHING METHODOLOGY

Theoretical classes with non-mandatory attendance. Student participation will be encouraged, trying to fix two common flaws that tend to have first-year students at the university: fear of asking questions and fear of being ridiculed for giving a wrong answer. In-person practical classes on problem-solving and learning concepts will be conducted using a computer program in the Computer Room, with mandatory attendance. The goal is to encourage student initiative and creativity, encouraging students to first find a way to solve them or to get an idea of what might happen with the help of a computer.

Practices will include assignments to be delivered to the teacher for correction. Attendance and participation in seminars. Active participation in regulated tutorials.

### EVALUATION

The evaluation will be conducted by:

- Objective test, consisting of an exam that will include both theoretical and practical questions and problems. The rate at which this test will influence the final grade will be 80%.
- All proposed assignments (primarily from practical classes and seminars) will be required. The rate at which the score of this work will influence the final grade will be 20%.

To request advance notice of this course, the student must have completed the compulsory activities indicated in the course's teaching guide.

### REFERENCES



- J. Stewart: Cálculo : Conceptos y contextos, Tercera Edición, Cengage Learning Ed. 2006.
- Claudia Neuhauser: Matemáticas para Ciencias, Ed. Pearson/Prentice Hall, Segunda edición, 2009.
- R.Larson, B.H. Edwards: Cálculo 1, Mc Graw Hill 2010.
- D.G. Zill, W.S. Wright: Cálculo de una variable, Mc Graw Hill 2011.
- James Callahan, Kenneth Hoffman, David Cox, Donal O'Shea, Harriet Pollatsek, Lester Senechal: ¿Calculus in Context. The Five College Calculus Project.¿, <https://scholarworks.smith.edu/textbooks/2/>
- S. L. Salas, E. Hille, G.J. Etgen. ¿Calculus. Una y varias variables¿, 2006, Ed. Reverté, Barcelona.
- S. T. Tan: Applied Calculus for the Managerial, Life, and Social Sciences, 5th Edition, Thomson Learning, Belmont 2002.
- G.B. Thomas, R.L. Finney: Cálculo con Geometría Analítica, 1987, Addison-Wesley Iberoamericana, Wilmington.
- David F. Parkhurst: Introduction to Applied Mathematics for Environmental Science Ed. Springer, 2006.
- Athel Cornish-Bowden: Basic Mathematics for Biochemists, Editorial: Oxford University Press (1999).
- Victoriano Ramírez, Pedro González, Miguel Pasadas y Domingo Barrera: MATEMÁTICAS CON MATEMATICA, Editorial: Proyecto Sur, 1997.