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|------------------|---------------------------|---------------|----------------|----------------------------|-----|
| Course Unit      | Mathematics               |               | Field of study | Mathematics and statistics |     |
| Bachelor in      | Biology and Biotechnology |               | School         | School of Agriculture      |     |
| Academic Year    | 2023/2024                 | Year of study | 1              | Level                      | 1-1 |
| Type             | Semestral                 | Semester      | 1              | ECTS credits               | 5.5 |
| Code             | 9029-782-1104-00-23       |               |                |                            |     |
| Workload (hours) | 148,5                     | Contact hours | T              | -                          | TP  |
|                  |                           |               | PL             | -                          | TC  |
|                  |                           |               | S              | -                          | E   |
|                  |                           |               | OT             | -                          | O   |

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Paula Sofia Alves do Cabo

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Understand the basis of linear algebra.
2. Understand the fundamentals of integral calculus.
3. Use differential and integral calculus to solve practical problems.
4. Solve Differential Equations.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Solve equations and inequations.
2. Understand functions of real variables: manipulation of graphs, limits and derivation.

### Course contents

Basic notions of Algebra: Determinants, Matrices, Systems of Linear Equations. Integral calculus in R: Primitives and integrals (integration by parts and by substitution). Apply integrals to the determination of area. Functions of several variables: partial derivatives, derivatives of composite and implicit functions, optimization of functions, with and without restrictions. Differential Equations.

### Course contents (extended version)

1. Basic notions of Algebra.
  - Determinants: Theorem of Laplace, Rule of Sarrus. Properties. Reduction to the triangular form.
  - Matrices: Basic concepts, Operations with matrices. Calculation of the inverse matrix.
  - Linear Equation Systems: Rule of Cramer, method of the inverse matrix and Gauss-Jordan.
2. Integral calculus: Primitives and Defined Integration.
  - Definition of primitive and indefinite integral.
  - Integration methods: Direct integration, integration by parts and by substitution.
  - Defined Integral: definition and geometric interpretation. Fundamental theorem of Calculus.
  - Application of integral calculus to the determination of surface area.
3. Chapter 3 – Functions of several variables
  - Definition of the concept of the function of several variables
  - Geometric interpretation.
  - Definition of the concept of partial derivation. Higher-order partial derivatives.
  - Derivation of composite functions of several variables
  - Derivation of implicit functions of (one and of) several variables
  - Maximums and minimums of functions of several variables
  - Conditional maximums and minimums. Method of the multipliers of Lagrange.
4. Ordinary Differential Equations (E. D. O)
  - Homogeneous and not homogeneous E. D. O of 1st order. Geometric interpretation.
  - Analytical resolution of E. D. O. to the separable variables or reductive to this form.

### Recommended reading

1. A. Quarteroni, R. Sacco e F. Saleri, "Numerical Mathematics", in Texts in Applied Mathematics, 37, 2nd edition Springer Berlin Heidelberg, 2007.
2. T. Apostol, Calculus, vol. I, 2nd edition, Editorial Reverté, Lda., 1999.
3. N. Piskounov, Cálculo Diferencial e Integral, vol. 1 e 2, Edições Lopes da Silva, 2000.
4. M. Ferreira e I. Amaral, Primitivas e Integrais, Edições Sílabo, 2006.
5. M. Ferreira e I. Amaral, Álgebra Linear, vol. I, Edições Sílabo, 2008.

### Teaching and learning methods

Lectures and problem-solving sessions for introduction and exploration of theoretical concepts, and application of the concepts through the resolution of problems. Knowledge integration by the assignment of practical works.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 30%
  - Intermediate Written Test - 25%
  - Intermediate Written Test - 20%
  - Final Written Exam - 25%
2. Alternative 2 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 25%
  - Intermediate Written Test - 20%
  - Intermediate Written Test - 15%
  - Practical Work - 20%
  - Final Written Exam - 20%
3. Alternative 3 - (Regular, Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

| Electronic validation     |                               |                        |                           |
|---------------------------|-------------------------------|------------------------|---------------------------|
| Paula Sofia Alves do Cabo | Carlos Manuel Mesquita Morais | Altino Branco Choupina | Paula Sofia Alves do Cabo |
| 23-01-2024                | 30-01-2024                    | 30-01-2024             | 09-04-2024                |

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