

Course Unit	Mathematics	Field of study	Mathematics and Statistics
Bachelor in	Environmental Engineering	School	School of Agriculture
Academic Year	2022/2023	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	175,5	Contact hours	T 30 TP - PL 45 TC - S - E - OT 20 O -
Level	1-1	ECTS credits	6.5
Code	9099-309-1103-00-22		

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) Carlos Manuel Mesquita Morais

### 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

1. Basic notions of Algebra: Matrices, Determinants, Systems of Linear Equations; 2. Integral calculus in R: Primitives and integrals (integration by parts and by substitution). Apply integrals to the determination of area; 3. Functions of several variables: partial derivatives, derivatives of composite and implicit functions, optimization of functions, with and without restrictions; 4. Differential Equations.

### Course contents (extended version)

1. Basic notions of Algebra.
  - Matrices: Basic concepts, Operations with matrices. Calculation of the inverse matrix.
  - Determinants: Theorem of Laplace, Rule of Sarrus. Properties. Reduction to the triangular form.
  - Linear Equation Systems: Rule of Cramer, method of the inverse matrix and method of 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. Functions of several variables.
  - Concept, definition and domain of the function of several variables.
  - Geometric interpretation.
  - Concept and definition of the 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.
  - Differential equations homogeneous and not homogeneous of 1st order. Geometric interpretation.
  - Resolution of ordinary differential equations of separable variables or reductive to this form.

### Recommended reading

1. Cabral, I. , Perdigão, C. , & Saiago, C. (2018). Álgebra Linear: Teoria, exercícios resolvidos e exercícios propostos com soluções (5.ª ed. ). Escolar Editora.
2. Ferreira, M. & Amaral, I. (2008). Álgebra Linear (vol. I). Edições Sílabo.
3. Ferreira, M. & Amaral, I. (2006). Primitivas e Integrais. Edições Sílabo.
4. Piskounov, N. (2002). Cálculo diferencial e integral (vol. I e vol. II). Editora Lopes da Silva.
5. Apostol, T. (1999). Calculus (vol. I, 2nd edition). Editorial Reverté, Lda.

### Teaching and learning methods

Expository method; Demonstrative method; Interactive method; Problem-based learning.

### Assessment methods

1. Continuous evaluation - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 50% (Rating greater than or equal to seven values.)
  - Intermediate Written Test - 50% (Rating greater than or equal to seven values.)
2. Assessment by exam - (Regular, Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 100%

### Language of instruction

Portuguese, with additional English support for foreign students.

### Electronic validation

Carlos Manuel Mesquita Morais	Lúisa Maria Lopes Pires Genésio	Artur Jorge de Jesus Gonçalves	Paula Sofia Alves do Cabo
04-12-2022	07-12-2022	08-12-2022	13-12-2022