

Course Unit	Mathematics	Field of study	Mathematics and Statistics
Bachelor in	Oenology	School	School of Agriculture
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	148,5	Contact hours	T - 60 TP - 60 PL - TC - S - E - OT 4 O -
		Level	1-1
		Code	9998-705-1103-00-23
		ECTS credits	5.5

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	António Castro Ribeiro	Paula Sofia Alves do Cabo
23-01-2024	30-01-2024	30-01-2024	09-04-2024