INSTITUTO POLITÉCNICO DE BRAGANÇA

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	Level	1-1	ECTS credits	6.5						
Type	Semestral	Semester	1	Code	9099-309-1103-00-22								
Workload (hours)	175,5	Contact hours	T 30	TP -	PL 45	TC -	S -	E -	OT 20	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): 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 fundaments 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	Luísa 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