

<b>POLI</b> ESCOLA SUPERIOR TECNOLOGIA GESTÃO <b>TÉCNICO</b> <b>GUARDA</b>	<b>SUBJECT DESCRIPTION</b>	<b>MODELO</b> PED.013.03
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Course	Computing Science Engineering					
Subject	Mathematical Analysis					
Academic year	2023/2024	Curricular year	1st	Study period	1st semester	
Type of subject	Compulsory	Student workload (H)	Total: 168	Contact: 90	ECTS	6
Professor(s)	António Antunes					
<input checked="" type="checkbox"/> Area/Group Coordinator <input type="checkbox"/> Head of Department		Graça Tomaz				

## PLANNED SUBJECT DESCRIPTION

### 1. LEARNING OBJECTIVES

*It aims that the student acquires knowledge and skills in terms of theoretical foundations and techniques for calculating the level of the syllabus laid down under the areas of linear algebra and mathematical analysis. It is also intended that students develop reasoning, comprehension and interpretation, as well as the ability to apply the acquired knowledge to solve specific problems related to the purview of the respective course.*

### 2. PROGRAMME

#### 1- Real Functions of Real Variable

- Definition. One-to-one functions, onto functions, monotone functions, limited functions, even and odd functions, periodic functions.
- Composite function and inverse function.
- Elementary functions: exponential function; logarithmic function; circular trigonometric functions and their inverses.
- Limits, definition and fundamental theorems. Lateral limits. Generalization of a limit notion.
- Continuity, definition and properties. Bolzano-Cauchy and Weirstrass theorems.

#### 2- Differential Calculus on $\mathbb{R}$

- Notion of derivative and geometric interpretation. Lateral Derivative. Derivative rules. Derivative of composite function and inverse function. Tangent straight equation to the graph of a function.
- Rolle, Lagrange and Cauchy theorems. Cauchy rule.
- Derivatives of order  $n$ . Taylor's formula with Lagrange remainder. McLaurin formula.
- Extreme and inflection points. Convex functions and concave functions. Asymptotes to the graph of a function. Complete study of functions.

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### 3- Indefinite Integrals

- Indefinite integral. Immediate integrals. Integration methods: Integration by parts; integration by substitution; integration of powers of trigonometric functions; integration by partial fractions.

### 4- Definite Integral

- Definite integral. Fundamental properties. Fundamental Theorem of Integral Calculus. Integration by parts and by substitution.
- Applications of integral calculus to the calculation of areas.
- Improper integrals of 1<sup>st</sup> kind, 2<sup>nd</sup> kind and mixed.

## 3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The programmatic contents are set in accordance with the UC objectives, with a view to the development of calculus and mathematical thinking as support, and thus allowing students to foster the skills of logical reasoning and abstraction, in a controlled manner, demanding and effective, and its application in other Curricular Units, as well as future employment within the area of Computing Engineering.

## 4. MAIN BIBLIOGRAPHY

### Required:

- Apostol, T. M. (1985). *Calculus*, vol. II., Jonh Wiley & Sons, New York.
- Azenha, A. (2000). *Elementos de Cálculo Diferencial em  $\mathbf{R}$  e  $\mathbf{R}^n$* , McGraw-Hill.
- Ferreira, J. Campos (2005). *Introdução à Análise Matemática*. Fundação Calouste Gulbenkian.
- Leitão, G. (2022). *Caderno de Exercícios de Análise Matemática*, ESTG/IPG.
- Silva, J C (1994). *Princípios de Análise Matemática Aplicada*, McGRAW-HILL, Lisboa.

### Suggested:

- Breda, A.A. e Costa, J. N. (1996). *Cálculo com funções de Várias Variáveis*, McGraw-Hill, Lisboa.
- Guidorizzi, H. L. (2001). *Um Curso de Cálculo Vol I*.
- Lima, E. L. (1999). *Curso de Análise Vol 1*. Rio de Janeiro: Projeto Euclides.
- Piskounov, N (1986). *Cálculo Diferencial e Integral*, vol. I e Vol II., Lopes da Silva Editora, Porto.

## 5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

The methodologies will meet established objectives for UC, with expository and interactive lessons, intercalated with discussion and resolution of problems and practical exercises. In OT classes, students are encouraged to problem solving and individual research autonomously, involved in their learning and debugging.

**Continuous evaluation:** Four tests with a maximum duration of 1 hour, each with a quotation of 20 values. The arithmetic average of the classifications must be equal to or greater than 9,5 to obtain approval.

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**Evaluation by final exam:** normal season and resource season, with final classification greater than or equal to 10, to approval.

Compulsory oral test for classifications above 16 points. Tests will be without consultation and interdiction calculator and mobile phones.

## 6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

In the presentation of the concepts and results focus is objectivity, consistency and sequential logic, and fomented intuitive understanding of the concepts and the ability to calculate, using clear examples to develop scientific reasoning and mathematical ability and opening the application of concepts mathematicians. With this kind of methodology seeks to develop a solid foundation of training for the student to learn to apply and integrate the knowledge in new situations, in broad contexts and multidisciplinary.

## 7. ATTENDANCE

The evaluation process doesn't demand any mandatory lectures.

## 8. CONTACTS AND OFFICE HOURS

Email: [antonioantunes@ipg.pt](mailto:antonioantunes@ipg.pt)

Office: 42

Friday: 14h30m – 15h30m

## 9. OTHERS

Not applicable.

## DATE

12 de outubro de 2023

## SIGNATURES

Professor

(signature)

Area/Group Coordinator

(signature)