POLI ESCOLA SUPERIOR TECNOLOGIA GESTÃO TÉCNICO GUARDA	**SUBJECT DESCRIPTION**	**MODELO** PED.013.03

Course	**Topographic Engineering**					
Subject	**Mathematical Analysis II**					
Academic year	2023/2024	*Curricular year*	1st	*Study period*	2nd semester	
Type of subject	Compulsory	*Student workload (H)*	Total: 182	Contact: 60	*ECTS*	6,5
Professor(s)	César Gonçalves					
☒ *Area/Group Coordinator* ☐ *Head of Department* *(select)*	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 provided. 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- Differential Calculus on R^n.

1.1- Topological notions on R^n.

1.2- Basic concepts about functions defined on R^n.

1.2.1.- Definition and Examples.

1.2.2.- Domains. Level curves and level surfaces.

1.3- Scalar fields.

1.3.1.- Limits and Continuity.

1.3.2.- Partial derivatives.

1.3.3.- Differentiability. Derived directed. Gradient. Tangent plane.

1.3.4.- Partial derivatives of order higher than the first. Schwartz theorem.

1.3.5.- Hessian matrix. Derived directed of second order.

1.3.6.- Taylor formula.

1.4- Extremes of scalar fields.

1.4.1.- Free extremes.

1.4.2.- Conditioned extremes.

1.5- Vector fields.

1.5.1.- Limits, continuity and differentiability.

1.5.2.- Jacobian matrix and jacobian.

1.5.3.- Derivative of composite function and inverse function.

1.5.4.- Derivative of implicit function.

2- Integral Calculus on R^n.

2.1- Concept of integral on R^n. Main properties.

2.2- Double integrals.

2.2.1.- Calculation in cartesian coordinates.

2.2.2.- Applications to the calculation of areas and volumes.

2.2.3.- Calculation in polar coordinates.

2.3- Triple integrals.

2.3.1.- Calculation in cartesian coordinates.

2.3.2- Applications to the calculation of volumes.

2.3.3.- Calculation in cylindrical and spherical coordinates.

3- Differential Equations 1st order.

3.1- Definitions and examples.

3.2- Fundamental properties and theorems.

3.3-. Separate variables equations and separable equations.

3.4- Homogeneous equations.

3.5- Differential equations total exact and reducible to exact.

3.6- Linear differential equations of 1st order.

3.7- Differential equations linearized (Bernoulli).

3.8- Applications of differential equations.

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 Topographic Engineering.

4. MAIN BIBLIOGRAPHY

Required:

- Apostol, T. M. (1985). Calculus, vol. II., Jonh Wiley & Sons, New York.
- Azenha, A. (1995). Elementos de Cálculo Diferencial em **R** e $\mathbf{R}^n$, McGraw-Hill.
- Bronson, R., (1986). Moderna Introdução às Equações Diferenciais, McGraw-Hill.
- Gonçalves, C. R. (2014), Análise Matemática II – Resumo teórico, exercícios resolvidos e exercícios propostos, IPG.
- Gonçalves, C.R. (2024), Caderno de provas de avaliação (with solutions), didactic material prepared under the UC Mathematical Analysis II, ESTG.
- Gonçalves, C.R. (2015), Caderno de Exercícios- Mathematical Analysis II, didactic material prepared under the UC Mathematical Analysis II, ESTG-.
- 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.
- Lima, E. L.(1976). Curso de Análise Vol I e II, Projecto Euclides, Rio de Janeiro.
- 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. The students are encouraged to problem solving and individual research autonomously, involved in their learning and debugging.

Continuous evaluation: Two written tests with a minimum of 5 values in each test and final classification (arithmetic average) greater than or equal to 10, to permit exemption from examination and/or approval.

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

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

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.

6. ATTENDANCE

Not applicable.

7. CONTACTS AND OFFICE HOURS

Professor: César Gonçalves, crg@ipg.pt, Ext.1207, Gab. 7, Office Hours: Wednesdays 14:30 – 18:00

Area Coordinator: Graça Tomaz, gtomaz@ipg.pt, Ext.1233, Gab. 33

8. OTHERS

Not applicable.

DATE

February 15, 2024

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SIGNATURES

Professor

(signature)

Area/Group Coordinator

(signature)