| IPG Polytechnic of Guarda School of Technology and Management | **SUBJECT DESCRIPTION** | MODELO PED.013.02 |
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| *Course* | **Mechanics and Industrial Informatics** | | | *Academic year* | 2021/2022 | | |
| *Subject* | **Applied Mathematics I** | | | ECTS | 6,5 | | |
| *Type of course* | **Compulsory** | | | | | | |
| *Year* | **1st** | *Semester* | **1st** | *Student Workload:* | | | |
| *Professor(s)* | **Graça Maria de Oliveira Tomaz** | | | *Total* | 175,5 | *Contact* | 90 |
| *Area Coordinator* | **Joaquim Manuel Pereira Mateus** | | | | | | |

**Planned SD**

## 1. LEARNING OBJECTIVES

Provide students with basic knowledge of Differential Calculus and Integral Calculus of real functions and matrix calculus becoming thus equipped with a conceptual theoretical framework and calculus skills needed to the understanding and development of mathematical applications within the scope of the course.

## 2. PROGRAMME

1. Real-valued functions of a real variable
   - 1.1. Definition and examples; composite function; inverse function.
   - 1.2. Elementary functions: exponential, logarithmic, and trigonometric functions and their inverses.
2. Limits and continuity of real functions
   - 2.1. Limits.
   - 2.2. Continuous functions: definition and examples.
   - 2.3. Fundamental properties of the continuous functions.
3. Differential calculus of real functions
   - 3.1. Derivatives: derivative at a point; geometrical interpretation.
   - 3.2. Derivative function; derivative rules.
   - 3.3. Derivative of higher order.
   - 3.4. Theorems on differential functions.
   - 3.5. Applications of the differential calculus.
4. Indefinite integral of real functions
   - 4.1. Immediate indefinite integrals. Integration methods.
   - 4.2. Integration of rational functions.
5. Definite integrals of real functions
   - 5.1. Riemann integral: definition, examples, and properties.
   - 5.2. Fundamental theorem of the integral calculus.
   - 5.3. Integration by parts and substitution.
   - 5.4. Application of the definite integrals to find areas.
6. Linear algebra
   - 6.1. Matrices: classification, operations, rank, and inverse. Application to solve linear systems of equations.
   - 6.2. Determinants:.definition, properties, Laplace Theorem, adjoint matrix, and inverse matrix. Application to solve linear systems.

## 3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The programme is designed to provide the basic contents in the areas of Mathematical Analysis and Linear Algebra so that students have the essential tools to solve concrete problems.

## 4. MAIN BIBLIOGRAPHY

Compulsory

1. Stewart, J. (2017). Cálculo, Vol I, Tradução da 8ª edição norte-americana, Cengage Learning.
2. Herman, E. & Strang, G. (2016). Calculus, vol. 1, OpenStax. (Disponível online em: https://openstax.org/details/books/calculus-volume-1 ).
3. Kolman, B. & Hill, D. R. (2013). Álgebra Linear com Aplicações, Editora LTC, Rio de Janeiro.
4. Santana, A. P., Queiró, J. F. (2010). Introdução à Álgebra Linear. Gradiva, Lisboa.
5. Strang. G. (2009). Introduction to Linear Algebra. Wellesley-Cambridge Press.

Recommended

1. Apostol, T. M. (1985). Cálculo, Vol. I, Editora Reverte, Rio de Janeiro.
2. Ferreira, J. C. (1995). Introdução à Análise Matemática, Fundação Calouste Gulbenkian, Lisboa.

## 5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Methodology: The teaching methodologies include lectures and interactive classes: theoretical classes with the resolution and discussion of exercises and problems addressing the issues in a practical and objective way in order to engage students in their learning process.

Continuous Evaluation: Two written tests. Those students who obtain a minimum grade of 5 in each test and a final classification (arithmetic average) equal to or higher than 10 (out of 20) are exempted from the final exam.

Final Evaluation: exam (final exam and/or recourse exam). Students should have a final exam grade equal to and/or higher than 10 (out of 20) to obtain approval.
Compulsory oral exam for classifications higher than 16. All the written tests are closed-book tests and the use of calculators or mobile phones is interdict.

## 6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

The expository method is used in order to present the theoretical concepts fundamental to the understanding of the programme. The interactive method is consistent with the objectives as the

professor solves some exercises by asking students' participation and promoting the exchange of ideas among all students. Problem solving is also in line with the objectives of the curricular unit as it is the application of the theoretical contents to the practical problems that allow students to consolidate the subject matter that has been taught.

## 7. ATTENDANCE

N.A.

## 8. CONTACTS AND OFFICE HOURS

Professor: Graça Tomaz (PhD); gtomaz@ipg.pt; office n.º 33

Area Coordinator: Joaquim Mateus (PhD); jmateus@ipg.pt; office n.º 30

Date: 30/06/2021