

<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	Data Science and Artificial Intelligence					
Subject	Numerical Methods					
Academic year	2023/24	Curricular year	2nd	Study period	2nd	
Type of subject	Compulsory	Student workload (H)	Total: 168	Contact: 75	ECTS	6
Professor(s)	Fernando Pires Valente					
<input checked="" type="checkbox"/> Area/Group Coordinator <input type="checkbox"/> Head of Department		(select)	Fernando Pires Valente			

## Planned SD

### 1. LEARNING OBJECTIVES

*Provide students with knowledge and skills in the field of numerical analysis that enable them to understanding matters of other subjects of the course and the application of that knowledge in professional life, in particular, understanding of basic concepts of theory of error, problem-solving capacity of non-linear equations, interpolation, solving systems of linear and nonlinear equations, solving problems of approximation and integration and approximate resolution of differential equations.*

### 2. PROGRAMME

#### **Theory of errors**

*Absolute and relative errors. Approximation of functions. Condition number.*

#### **Non-linear Equations**

*Separation of roots. Estimation of approximation. Polynomial equations. Rules of Descartes, Lagrange and Budan. Methods of the bipartition, false position, secant, Newton and fixed point.*

#### **Interpolation**

*Lagrange and Newton formulas. Divided differences. Inverse interpolation. Errors. Interpolation with equidistant nodes.*

#### **Systems of linear equations**

*Direct methods. Triangular factorizations. Jacobi and Gauss-Seidel iterative methods. Convergence.*

#### **Systems of non-linear equations**

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*Methods of successive approximations and Newton.*

### **Approximation**

*Least squares approach of a set of points. Adjustment functions. Approximation of continuous functions.*

### **Numerical integration**

*Trapezoidal and Simpson rules. Errors. Composite rules. Gauss formulas.*

### **Differential equations**

*Integration by Taylor series. Euler method, convergence. Runge-Kutta methods. Multiple step formulas.*

## **3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES**

*The syllabus of UC are the classic content from any biannual discipline of numerical analysis or numerical methods in an engineering course of higher education in Portugal or any developed country and allow you to achieve the goals set out in point 1.*

## **4. MAIN BIBLIOGRAPHY**

1. Valente, F. P., **Análise Numérica**, Edição do IPG, 2021.
2. Valente, F. P., **Análise Numérica**, Tópicos e Problemas, Edição do IPG, 2018.
3. Valente, F. P., **Métodos Numéricos**, Coletânea de problemas resolvidos para a UC, 2020.
4. Pina, H. L. G., **Métodos Numéricos**, Escolar Editora, 2010.
5. Conte, S. D. e De Boor, C., **Elementary Numerical Analysis**, McGraw-Hill, 1980.
6. Asaithambi, N. S., **Numerical Analysis**, Saunders College Publishing, 1995.
7. Atkinson, K. E., **An Introduction to Numerical Analysis**, John Wiley & Sons, 1989.
8. Hildedrand, F. B., **Introduction to Numerical Analysis**, Dover, 1974.
9. Ralston, A. e Rabinowitz, P. A., **A First Course in Numerical Analysis**, McGraw-Hill, 1978.

## **5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)**

*Theoretical-practical training with practical resolution of application examples. Two tests during the semester with an average of 10 values and note at least 5 values in each one. Frequency or final exam with 10 values.*

## **6. COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES**

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*The teaching methodology used is mainly theoretical and practical with a short exposure of the essential theoretical concepts of subjects taught, followed by the resolution of practical problems where possible linked to an engineering course, using scientific calculator. It is intended so that the knowledge gained to consolidate so they turn to the professional life.*

#### **7. ATTENDANC**

*Students must attend at least 2/3 of the class hours.*

#### **8. CONTACTS AND OFFICE HOURS**

Fernando Pires Valente, [fpvalente@ipg.pt](mailto:fpvalente@ipg.pt), Office 46; Ext. 1246

#### **DATE**

**21 de fevereiro de 2024**

