CALCULUS

Degree in Electrical and Computer Engineering

Code: 10209

Main Scientific Area: Mathematics and Statistics

Lecturer: Andreia Alves Forte de Oliveira Monteiro

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 60h Total Workload: 100h

ECTS: 6,0

Objectives

The aim of the course is to provide students with the mathematical and numerical calculations that support the

specific subjects of the course.

Learning Outcomes

The student should be able to: a) analyze functions, b)recognize the shape of a set of specific functions and

c)perform operations of differential and integral calculus

Student should also be able to use numerical methods when algebraic calculation is not possible.

Course Contents

Chapter 1 Limits and Continuity of functions

1 Real functions of variable real

2 Limits of real functions of variable real

2.1 Concept of limit. General properties

2.2 One Sided Limits

2.3 Limits on infinity and infinite limits (Indeterminate)

2.4 Asymptotic Study

3 .Continuity

3.1 Continuous Functions. General properties

3.2 Fundamental Theorems of Continuity

4. Asymptotic Study

4.1 Vertical Asymptotes

4.2 Horizontal Asymptotes

4.3 Obliquel Asymptotes

Chapter 2 Trigonometric and Trigonometric Inverse Functions

1. Arc Sine

2. Arc-Cosine

3. Arc-Tangent

4. Arc-Cotangent

Chapter 3 Differentiability

1. Definition and properties

2. Fundamental Theorems of Differentiability

3. Study of Functions

Chapter 4 Nonlinear Equations

1. Roots of functions 2. Roots separation

2.1 Graphic method

2.2 Rolle Numbers

3. Iterative methods

3.1 Bisection method

3.2 False Position method

3.3 Fixed point iteration

3.4 Newton-Raphson method

3.5 Comparison between methods

Chapter 5 Interpolation and Polynomial Approximation

1. Polynomial Interpolation

2. Calculation of polynomial interpolation

2.1 Lagrange Method

2.2 Newton Method

3. Interpolation errors

4. Comparison between the methods

5. Choose the degree of the polynomial interpolator

Chapter 6 Integration.

1. Riemman Integration. Sufficient Conditions of Integrability

2. Properties of Riemann Integral

3. Indefinite Integral/Antiderivate

4. Integration by Parts

5. Integration by Substitution

6. Areas

Chapter 7. Numerical Integration

1. Numerical Integration

2. Newton-Cotes Integration

2.1 Trapeziodal Rule

2.2 Simpson’s 1/3 Rule

2.3 Simpson’s 3/8 Rule

3. Error of Newton-Cotes Integration

Chapter8 - Laplace Transform

1.Definition ofLaplace Transform.

2. Propertiesand theoremsof Laplace Transform.

Recommended Bibliography

Ferreira, J.C. (2011). Introdução à Análise Matemática, Fundação Calouste Gulbenkian.

Rodrigues, J.A. (2003). Métodos Numéricos-Introdução aplicação e Programação (11ªedição). Sílabo.

Valença, M.R. (1993). Métodos Numéricos. Livraria Minho.

Valença, M.R. (1996). Análise Numérica. Universidade Aberta.

Learning and Teaching Methods

The understanding, manipulation and application of the concepts of differentiability and integrability of real valued

functions provide some essential mathematical knowledge required for the proper functioning of other units of the

course curriculum.

They also allow to develop the scientific reasoning and the mathematical ability to the application of the

mathematical concepts.

Assessment Methods

Evaluation of the students

-Two tests (T1 and T2), one in the middle of the semester and the other at the end of the semester (85%)

The second test has a minimum score of 7 values.

-One mandatory work(T) (15%)

- Final Mark: 0,425*T1+0,425*T2+0,15*T

Note:

Students who fail to pass (final score less than 9.5) may attend the Exam, taking the exam grade a weight equal to

100%.