DISCRETE MATHEMATICS AND LINEAR ALGEBRA

Degree in Electrical and Computer Engineering

Code: 10206

Main Scientific Area: Mathematics and Physics

Lecturer: Teresa Paula Amaral Abreu

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 60h Total Workload: 100h

ECTS: 6,0

Objectives

It is intended with this course to give mathematical basic formation for the specific courses of the undergraduate programme, in order to help students to develop their capacities of calculation, logical and abstract reasoning; acquiring the necessary knowledge for applications in the most diverse scientific branches, especially in engineering areas.

Learning Outcomes

Skills to develop: operate with matrices and solve systems of linear equations using matrix calculations; interpret and apply concepts associated with vector spaces; calculate the determinant of a matrix; know the language of graph theory and its applications in real life situations.

Course Contents

1stPart – Linear Algebra

Matrices. Matrix language. Matrix operations. Matrices as representation of concrete situations.

Systems of linear equations.Approach to the studyof systems of linear equations. Systems of two equations and two unknowns. Systems of three equations and three unknowns. Systems ofmequations andnunknowns. Solving systems of linear equations. Limitations of the methods of solving systems of linear equations. Gauss elimination method. Characteristic of a matrix and another discussion of system of linear equations.Algorithm to determine the inverse matrix.

Determinants. Definition and properties. Algorithm for the calculation the determinant of any order. The determinants and the inverse of a matrix.Determinantsin solving systems of linear equations.

Realvector spaces. Finding new “vectors”. Vector subspaces. Linear combination. Span of a set of vectors.Linear independence and dependence. Basis and dimension.

2ndPart – Discrete mathematics

Graph theory. Definitions and examples. Subgraphs. Bipartite and complete graphs. Paths and cycles. Eulerian paths and Hamiltonian cycles. Connectivity. Boolean matrix. Transitive closure. Planar graphs.

Network analysis. Networks. Minimum-spanning-tree problem. Shortest-path problem.

Recommended Bibliography

Gonçalves, R. (2022). Álgebra Linear - teoria e prática(3ª ed.). Lisboa: Sílabo.

Learning and Teaching Methods

Contents:Matrices. Matrix language. Matrix operations. Matrices as representation of concrete situations. Systems of linear equations.Approach to the studyof systems of linear equations. Systems of two equations and two unknowns. Systems of three equations and three unknowns. Systems ofmequations andnunknowns. Solving systems of linear equations. Limitations of the methods of solving systems of linear equations. Gauss elimination method. Characteristic of a matrix and another discussion of system of linear equations. Algorithm to determine the inverse matrix.

Main Objectives:operate with matrices and solve systems of linear equations using matrix calculations.

Contents:Determinants. Definition and properties. Algorithm for the calculation the determinant of any order. The determinants and the inverse of a matrix.Determinantsin solving systems of linear equations.

Main Objectives:calculate the determinant of a matrix.

Contents:Realvector spaces. Finding new “vectors”. Vector subspaces. Linear combination. Span of a set of vectors. Linear independence and dependence. Basis and dimension.

Main Objectives:interpret and apply concepts associated with vector spaces.

Contents: : Graph theory. Definitions and examples. Subgraphs. Bipartite and complete graphs. Paths and cycles. Eulerian paths and Hamiltonian cycles. Connectivity. Boolean matrix. Transitive closure. Planar graphs. Network analysis. Networks. Minimum-spanning-tree problem. Shortest-path problem. Maximum-flow problem.

Main Objectives:know the language of graph theory and its applications in real life situations.

Assessment Methods

The attendance with participation means 5% of the final grade.

Throughout the semester students will respond to an assign task (15% of classification).

Students will have two tests, one at mid-semester and another at the end of it. The first one have a weight of 39% and the another one 26% . The secon test haveminimum at 7 values.

In the 1st test or each exam, students will respond to a practical part involving the use of Scilab software 15% of grade).

If the final grade is less than 9.5 points, the student is not approved in the curricular unit. In this case, may attend the examination of appeal, with a weight of 65% and the same remain elements of evaluation.For Medical Informatics Engineering students enrolled in at least 4 curricular units, the practical work will be replaced by the completion of the project. The completion of the project is mandatory.