

# Linear Algebra

**Calendar:** 1<sup>st</sup> day semester

**Contact Hours:** T 30,0h; TP 30,0h; OT 15,0h

**Scientific Area:** Mathematics and computer science

**Intended learning outcomes (knowledge, skills and competences to be developed by the students):** Acquire some calculus techniques which are widely used in other curricular units; among these techniques we highlight matrix techniques, representation of linear equation systems and their resolution, determinants and their applications as well as linear spaces and linear transformations.

## **Syllabus:**

Matrices: Definition. Special matrices. Algebraic operations with matrices. Classification of matrices according to their properties. Linear combination of rows and columns of a matrix. Linear (in)dependence of rows and columns of a matrix. Matrix equations. Gauss elimination. Rank of a matrix. Inverse matrix and its properties.

Determinants: Definition. Sarrus rule. Determinant calculus via triangular factorization. Adjoint matrix.

Solution of linear systems using Cramer's rule. Linear spaces Revisions of vector calculus.

Linear spaces: Linear combination, linear (in)dependence, generators, basis and dimension. Linear subspaces.

Linear transformations: Linear transformations and their properties. Kernel and image space. Generators, bases and dimension of kernel and image spaces.

Eigenvectors and eigenvalues: Characteristic polynomial. Calculus of eigenvectors and eigenvalues.

Inner product, cross product and mixed product: Definition and geometric interpretation. Properties.

**Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:**

The various calculus tools that a student should be able to manipulate on completing the curricular unit are included in the syllabus. The way of transmission of those tools combined with the practical way of working with them allow the attainment of the targets.

**References:**

- Magalhães, L. (1998). Álgebra Linear como Introdução a Matemática Aplicada, Texto Editora. Dias Agudo, F. R. (1996). Introdução à Álgebra Linear e Geometria Analítica, Livraria Escolar Editora. Lang, S. (1997). Introduction to Linear Algebra, Springer.
- Strang, G. (2005). Linear Algebra and Its Applications, Academic Press.
- Monteiro A. e Pinto G. (1997), Álgebra Linear e Geometria Analítica, McGraw-Hill.
- Steven J. L. (2014). Linear Algebra with Applications (9th Edition), Pearson