

27056 - Linear algebra II

Syllabus Information

Academic year: 2024/25

Subject: 27056 - Linear algebra II

Faculty / School: 100 - Facultad de Ciencias

Degree: 647 - Degree in Mathematics

ECTS: 6.0

Year: 1

Semester: Second semester

Subject type: Basic Education

Module:

1. General information

In this course, more advanced concepts of linear algebra are studied. In a first block of contents, the vector space structure is enriched by the introduction of an inner product. In a second block, the theory of canonical forms under matrix similarity is studied. The common thread is the classification of matrices with respect to different equivalence relations that arise among them in natural ways.

2. Learning results

- Understand the basic concepts of inner product spaces (norm, orthogonal and orthonormal bases, orthogonal complement, orthogonal projection)
- Know how to apply the Gram-Schmidt algorithm
- Know the different types of operators in inner product spaces according to their relation with their adjoint
- Understand the spectral theorem and know how to find in practice both the unitary diagonalisation of a normal matrix and the orthogonal diagonalisation of a symmetric matrix
- Know how to find the orthogonal canonical form of an orthogonal operator in low dimension
- Know how to diagonalise a quadratic form, both orthogonally and under congruence, and understand the significance of Sylvester's law of inertia
- Understand the fundamental notions of the theory of canonical forms (minimum polynomials, cyclic subspaces, invariant factors, elementary divisors, generalised eigenspaces)
- Know how to find in practice the canonical forms (rational by invariant factors, rational by elementary divisors, and Jordan) of a linear operator
- Know how to interpret a substantial part of the course results in terms of matrix classification

3. Syllabus

- Inner product spaces
- Operators in inner product spaces
- Bilinear and quadratic forms
- Canonical forms

4. Academic activities

Master classes: 45 hours.

Problem solving: 15 hours.

Study: 90 hours.

Assessment tests: 4 hours.

5. Assessment system

- Continuous evaluation test (EC) at mid-semester, accounting for 20% of the final grade (CF)
- Global test (PG) at the end of the semester, accounting for the remaining 80%
- The final grade will be $CF = \max(0.2 \cdot EC + 0.8 \cdot PG, PG)$

6. Sustainable Development Goals

4 - Quality Education

5 - Gender Equality

8 - Decent Work and Economic Growth