

## 27000 - Linear algebra

### Syllabus Information

**Academic Year:** 2022/23

**Subject:** 27000 - Linear algebra

**Faculty / School:** 100 - Facultad de Ciencias

**Degree:** 453 - Degree in Mathematics

**ECTS:** 13.5

**Year:** 1

**Semester:** Annual

**Subject Type:** Basic Education

**Module:**

## 1. General information

### 1.1. Aims of the course

That the student acquire the fundamental concepts and procedures of linear algebra and, meanwhile, that they develop their ability for abstract reasoning.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the learning outcomes of the module provides training and competence to contribute to some extent to their achievement: (4) Quality education, (5) Gender equality, (8) Decent work and economic growth, (9) Industry, innovation and infrastructure, (10) Reducing inequality, (17) Partnerships for the goals.

### 1.2. Context and importance of this course in the degree

The concepts and procedures of linear algebra are pervasive in mathematics, from linear geometry to functional analysis, including differential equations.

### 1.3. Recommendations to take this course

To study the theoretical contents on a regular basis, to try to solve the proposed exercises, and to resort to tutorials when necessary.

## 2. Learning goals

### 2.1. Competences

Among the general competences acquired by the student, we emphasise the following ones:

- CT1. Know how to express clearly, in writing as well as orally, reasonings, problems, reports, etc.
- CT3. Discern, when confronted with a problem, what is substantial from what is superfluous. Formulate conjectures and be able to reason in order to either confirm or refute them. Identify mistakes in incorrect reasonings, etc.
- CE1. Understand and use mathematical language and methods. Know rigorous proofs of basic theorems in different branches of mathematics.
- CE3. Solve mathematical problems by basic calculus skills and other techniques.

### 2.2. Learning goals

- Operate with vectors, bases, subspaces and linear transformations.
- Solve systems of linear equations.
- Classify matrices and linear transformations according to different criteria.
- Study of eigenvalues and eigenvectors. Diagonalisation and canonic forms of matrices.
- Diagonalisation of quadratic forms. Computation of the signature.

- Classification of normal operators in Euclidean and unitary spaces.

### **2.3. Importance of learning goals**

See 1.2.

## **3. Assessment (1st and 2nd call)**

## **4. Methodology, learning tasks, syllabus and resources**

### **4.1. Methodological overview**

The learning process will be based on lectures, problem-solving sessions, individual tutorials and autonomous study. Classroom materials will be available via Moodle.

### **4.2. Learning tasks**

The course is organised in 105 hours of lectures and 30 hours of problem-solving sessions.

### **4.3. Syllabus**

1. Systems of linear equations and matrices.
2. Vector spaces.
3. Linear transformations.
4. Determinants.
5. Diagonalisation.
6. Bilinear, quadratic and Hermitian forms.
7. Euclidean and unitary spaces.
8. Operators in Euclidean and unitary spaces.
9. Canonical forms.

### **4.4. Course planning and calendar**

Besides the academic calendar fixed by the Faculty of Sciences, the continuous assessment exam dates will be fixed with the students.

### **4.5. Bibliography and recommended resources**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=27000>