Universidad Zaragoza

Academic Year/course: 2023/24

27010 - Linear Geometry

Syllabus Information

Academic year: 2023/24
Subject: 27010 - Linear Geometry
Faculty / School: 100 - Facultad de Ciencias
Degree: 453 - Degree in Mathematics
ECTS: 6.0
Year: 2
Semester: First semester
Subject type: Compulsory
Module:

1. General information

Basic notions and results of a geometric nature are introduced using the previously acquired knowledge of linear algebra. The fundamental concepts of affine and Euclidean geometry are introduced, with a special focus on the plane and space. This will be especially useful in order to recognize geometric objects and their properties in other areas of mathematics and sciences.

The approaches and objectives of this module are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda; the learning activities could contribute to some extent to the achievement of the goals 4 (quality education), 5 (gender equality), 8 (decent work and economic growth), and 10 (reducing inequality).

2. Learning results

- Operate with points, vectors, distances, and angles both in affine and Euclidean spaces, as well as the corresponding reference systems, subspaces, and their transformations.
- Know how to solve geometrical problems on the plane and space.
- Classify plane and space isometries determining their type and characteristic elements.
- Classify conics and quadrics and determine their intrinsic elements.

3. Syllabus

1. **Affine spaces.** Definition of affine spaces. Examples. First properties. Linear varieties and affine subspaces. Relative position of affine subspaces. New affine spaces from old. Grassmann formulas. Affine references and coordinates. Barycenter. Simple ratio. Thales, Ceva, and Menelao Theorems. Exercises.
2. **Affine morphisms.** Definition of affine morphisms. Properties of affine morphisms. Examples. Homologies on the plane. Affine morphisms in coordinates. Invariant affine subspaces. Exercises.
3. **Euclidean affine spaces and motions.** Euclidean affine space. Pythagorean Theorem. Distance between linear varieties. Definition of Euclidean motions. Examples. Gliding vector. Classification of Euclidean motions. Motions on the plane and three-dimensional space. Geometric interpretation. Exercises.
4. **Quadrics and affine classification.** Equivalent quadratic polynomials. Invariants and classification theorems. Affine classification of conics. Three dimensional quadrics. Quadrics with center. Exercises.

4. Academic activities

Master classes: 42 hours.
Problem solving: 14 hours.
Computer classes: 4 hours.
Study: 84 hours.
Assessment tests: 6 hours.

5. Assessment system

- Evaluation throughout the course (10%): classwork, lab exercises and individual or group projects.
- Final exam (90%).

In addition, according to current bylaws, the student also has the right to show up to a final exam and complete the class upon passing the test.