Universidad Zaragoza

Academic Year/course: 2023/24

27043 - Algebraic Curves

Syllabus Information

Academic year: 2023/24
Subject: 27043 - Algebraic Curves
Faculty / School: 100 - Facultad de Ciencias
Degree: 453 - Degree in Mathematics
ECTS: 6.0
Year: 4
Semester: First semester
Subject type: Optional
Module:

1. General information

This is an optional subject in the maths degree that serves as an introduction into two of the most classical fields in mathematics: algebra and geometry combined. The main objective is to present a brief introduction to algebraic geometry and to establish the deep connection between algebraic and geometric notions, stressing the fact that this provides an enriched point of view in both fields.

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

- Understand the relationship between notions and methods from algebra and geometry.
- Provide local characterizations of geometric objects.
- Calculate multiplicities and intersection multiplicities.
- Compute multiplicities and intersection multiplicities.

3. Syllabus

1. **Algebraic preliminaries.** Commutative rings and ideals. Rings of fractions. Noetherian rings.
2. **Polynomial rings.** Homogeneous polynomials. The Hilbert basis theorem.
3. **Affine varieties.** Affine algebraic sets and ideals of sets of points. Hilbert's nullstellensatz.
4. **Morphisms and Zariski topology.** Polynomial and rational maps. Zariski's topology.
5. **The projective space.** Projective algebraic sets. Projective closure. Projective version of Hilbert's nullstellensatz.
6. **Algebraic plane curves.** Parametrizable curves. Local properties: singularities, tangents and multiplicities. Multiplicities and local rings. Bézout’s theorem.
7. **Appendix:**Applications in cryptography, topological interpretation, curves in prime characteristic and Riemann's conjecture.

4. Academic activities

Master classes: 45 hours.
Problem solving: 15 hours.
Study: 85 hours.
Assessment tests: 5 hours.

5. Assessment system

Any student will be guaranteed the right to pass the subject by a final comprehensive exam. Alternatively, the student will be given the possibility to pass the subject by continuous evaluation as follows:

- 50% of the final mark by the resolution of three sets of exercises that will be orally defended.
- 30% from exercise solving in class.

- 20% by the elaboration of an individual academic project on a subject related to the course.