

## 27017 - Galois Theory

### Syllabus Information

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**Academic year:** 2023/24

**Subject:** 27017 - Galois Theory

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

**Degree:** 453 - Degree in Mathematics

**ECTS:** 6.0

**Year:** 3

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The main goal of this course is to introduce the students to the basic aspects of group theory and of Galois theory. The algebraic structure of groups is the structure that allows the study of the symmetries that appear in algebra, geometry, physics... On the other hand, Galois theory uses group theory to study field extensions and algebraic equations.

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

- Make computations in some particular groups (cyclic, dihedral, symmetric of small degree) and rings (of numbers, polynomials and matrices).
- Be familiar with group actions, Sylow theorems and be able to use them to describe the structure of a given group.
- Work with expressions involving algebraic and transcendental elements.
- Compute explicitly some Galois groups.
- Work with the Galois correspondence and learn the characterization of solvability by radicals of polynomial equations.

### 3. Syllabus

1. Groups: basic notions.
2. Groups of permutations.
3. Group actions and simplicity of  $A_5$ .
4. Rings, fields, polynomials and existence of roots.
5. Field extensions. Algebraic extensions.
6. Normal extensions. The Galois group.
7. The Galois theorem. Solvable groups. Solving equations by radicals.

### 4. Academic activities

Master classes: 30 hours.

Problem solving: 30 hours.

Study: 85 hours.

Assessment tests: 5 hours.

### 5. Assessment system

There will be a partial exam P, graded with a maximum of 10 points, and a comprehensive final exam (during the official period for these exams). The final exam will split into two parts, A and B, each one graded with a maximum of 10 points. The final mark obtained by a student will be the maximum of  $0.5P + 0.5B$  and  $0.5A + 0.5B$ . Students who are successful in the partial exam are allowed not to take part A of the final exam.

The final mark in July will be the mark obtained in July's comprehensive final exam.

In the English option, the exams must be written in English. Otherwise they will not be marked.