

**COURSE DATA****DATA SUBJECT****Code:** 34169**Name:** Algebraic equations**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2026-27**STUDY (S)**

| Degree   | Center                               | Acad. year | Period         |
|--|--------------------------------------|------------|----------------|
| 1107 - Degree in Mathematics                     | Facultat de Ciències<br>Matemàtiques | 3          | First quarter  |
| 1928 - Double Degree Program Physics-Mathematics | Facultat de Ciències<br>Matemàtiques | 5          | Second quarter |

**SUBJECT-MATTER**

| Degree   | Subject-matter             | Character  |
|--|----------------------------|------------|
| 1107 - Degree in Mathematics                     | Algebraic structures       | COMPULSORY |
| 1928 - Double Degree Program Physics-Mathematics | Quinto Curso (Obligatorio) | COMPULSORY |

**COORDINATION**

SANUS VITORIA LUCIA

NAVARRO ORTEGA GABRIEL

**SUMMARY**

The aim of this course is to present the basic concepts and results of Galois theory and its application to the solvability of equations by radicals. This problem, one of the oldest in the history of mathematics, has its origin in Babylonian times, culminating in the work of Galois, who created the theory to characterize solvable equations by radicals. In this course we will begin to introduce this issue in the historical context. After reviewing the basic concepts of the theory of rings, polynomial rings fundamentally, and irreducibility criteria, we develop the rudiments of the theory of fields.

We will see how to translate the main problems into problems in the theory of groups.

f groups.

**PREVIOUS KNOWLEDGE**



## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

## OTHER REQUIREMENTS

A good monitoring of the subject happens to have in mind the theory of vector spaces, discussed in the course Linear Algebra and Geometry I, as well as group theory and ring theory given in the subject Algebraic Structures.

## COMPETENCES / LEARNING OUTCOMES

### 1107 - Degree in Mathematics

Adapting to new situations.

Capacity for analysis and synthesis.

Capacity for criticism.

Capacity for organization and planning.

Capacity of abstraction and modeling.

Expressing mathematically in a rigorous and clear manner.

Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.

Learn autonomously.

Possess and understand the mathematical knowledge.

Reason logically and identify errors in the procedures.

## DESCRIPTION OF CONTENTS

### 1. Irreducibility of polynomials.

### 2. Field extensions. Splitting fields of polynomials



### 3. Galois extensions. Fundamental theorem of Algebra

### 4. Solvable groups. Resolubility of equations by radicals.

## WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity            | Hours        |
|---------------------|--------------|
| Theory              | 30,00        |
| Other activities    | 7,50         |
| Classroom practices | 22,50        |
| <b>Total hours</b>  | <b>60,00</b> |

### NON PRESENCIAL ACTIVITIES

| Activity                              | Hours        |
|---------------------------------------|--------------|
| Attendance at other activities        | 0,00         |
| Individual or group project           | 0,00         |
| Independent study and work            | 24,00        |
| Preparation of lessons                | 49,50        |
| Preparation for assessment activities | 16,50        |
| Resolution of case studies            | 0,00         |
| <b>Total hours</b>                    | <b>90,00</b> |

## TEACHING METHODOLOGY

Attendance is strongly recommended both the lectures and classes of problems.

In the lectures we give the necessary and important for understanding and troubleshooting tools.

In the problem-solving classes will deepen the assimilation and understanding of the concepts developed in the lectures by solving problems and exercises. This work will be completed by the explanations made by the teacher on board and the active participation of students in the discussion of the various arguments used in solving problems.

This course will also provide resources through the Virtual Classroom. In the same we will incorporate statements of the lists of issues and additional material that may complement the lectures and problems.

## EVALUATION



The mark obtained in the exam will count 75% of the final grade. The seminar will note the 10% and 115% continuous assessment.

In the second call, the evaluation system will be the same.

To pass you must obtain a minimum grade of 4 out of 10 on the test.

## REFERENCES

- D. S. DUMMIT, R. M. FOOTE, Abstract Algebra. John Wiley & Sons, 2004 (1999, 1991).
- G. NAVARRO ORTEGA, Un curso de Álgebra. Publicaciones de la Universitat de Valencia, 2002.
- T. W. HUNGERFORD, Algebra. Springer-Verlag, 1974. - N. JACOBSON, Basic Algebra. Vol.1. W.H. Freeman and Company, 1985.
- D. COX, Galois Theory. John Wiley & Sons, 2004.
- J.B. FRALEIGH, A first course in abstract algebra. Adison-Wesley Publishing Co. 7th edition, 2002.
- D.J.H. GARLING, ¿A course in Galois Theory. Cambridge Univ. Press, 1986.
- J. MILNE, ¿Fields and Galois Theory, <http://www.jmilne.org/math/>
- F. CHAMIZO, Qué bonita es la teoría de Galois. Curso en la UAM, 2004. [http://www.uam.es/personal\\_pdi/ciencias/fchamizo/algebraIn.html](http://www.uam.es/personal_pdi/ciencias/fchamizo/algebraIn.html)
- A. M. de VIOLA PRIORI, J.E. de VIOLA PRIORI, Teoría de cuerpos y Teoría de Galois. Reverté, 2006.
- K. SPINDLER, ¿Abstract Algebra with Applications, Vol. I, II, Marcel Dekker, New York, 1994.