27017 - Galois Theory

Información del Plan Docente

Academic Year	2018/19
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

1.1.Aims of the course

Introduce the students to the basic aspects of Group Theory, which deals with symmetry, as well as Galois Theory, which uses Group Theory to study field extensions and algebraic equations.

1.2.Context and importance of this course in the degree

This course presents a key tool in any mathematical area: the Theory of Groups, which is the tool to measure and take advantage of the symmetries that may appear in any system. It is therefore a basic course.

1.3.Recommendations to take this course

This course assumes an interactive approach in its structure and in its presentation, which requires engaged participation from all members of the class. The student's presence is essential to the liveliness of this course and concomitantly to their individual success in it. Therefore, regular attendance is expected.
Students should work on the exercises and problems sheets regularly, should study on a continuous basis and should make use of the office hours (their schedule will be communicated at the beginning of the course).

2.Learning goals

2.1.Competences

Being succesful in this course should mean that the student is competent to

- Reason in an abstract way.
- Recognize the symmetries of a given situation and is able to use Group Theory to study it.
- Know about some of the classical mathematical problems, like the unsolvability of the quintic by radicals.
- Be able to write and communicate abstract concepts of Mathematics.
- Be able to learn by oneself, and to look for information through different media.

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2.2.Learning goals

- Become familiar with group concepts.
- Be able to use Group Theory to take advantage of symmetry.
- Learn about classical problems, like the unsolvability of the quintic by radical.

2.3.Importance of learning goals

Numbers and symmetry constitute two of the basic mathematical concepts. Both are blended in this course.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

20% of the final grade will be obtained by means of a continuous evaluation throughout the course. This will include solving exercises sheets and share the information with the classmates.
There will be a final exam which will amount for the remaining 80% of the final grade.
The student has the right to base his/her final graded on just a global exam.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving sessions and tutorials.

4.2.Learning tasks

This course is organized as follows:

- **Lectures and problem-solving sessions**. During the lectures, the teacher will provide explanations on the topics covered by the notes that will be available at the ADD. In addition, the solutions of the proposed problems, previously considered by the students either in their individual or group work outside the class hours, will be discussed. The interaction between students and the teacher will be encouraged, so as to increase the students' capacity for abstract reasoning, and to improve their level of mathematical expression. In addition, some problems to be solved either individually or in small groups will be proposed to the students, notwithstanding the fact that exams will be individual.
- **Tutorials**. Some problems will be proposed to be solved in groups by the students which will have the opportunity of asking doubts during the office hours of attention to students. Those exercises will be similar to the ones that will be asked in the exams. Upon request, students also have the option of meeting the teacher at times different from the ones scheduled to that purpose.

4.3.Syllabus

This course will address the following topics:

- **Topic 1**. Groups: basic notions
- **Topic 2**. Groups of permutations
- **Topic 3**. Actions of groups
- **Topic 4**. Structure of finite groups
- **Topic 5**. Field extensions. Algebraic extensions
- **Topic 6**. Splitting extensions. Extensions of homomorphisms
- **Topic 7**. Normal extensions. The Galois group
- **Topic 8**. The Galois Theorem
- **Topic 9**. Solving equations by radicals

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4.4.Course planning and calendar

Four weekly lecture hours. Theoretical and practical parts will not be separated in advance.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

4.5.Bibliography and recommended resources

Galois Theory textbooks

1. J. Gaal, Classical Galois Theory. Chelsea Publishing Company, New York,1971.
2. P. M. J. McCarthy, Algebraic extensions of fields, Dover Publ. Inc., New York, 1991
3. G. Navarro, Un curso de álgebra. Publicaciones de la Universidad de Valencia, 2002
4. P. Ribenboim, L'Arithmétique des corps, Hermann, Paris, 1972.
5. J. Rotman, Galois Theory, Springer Verlag, New York, 1990.
6. I. Stewart, Galois theory, Chapman and Hall, London, 1973.

General algebra textbooks

1. N. Bourbaki, Elements of Mathematics, Algebra II. Springer Verlag, New
2. York, 1990.
3. P. M. Cohn, Algebra, vols. 1 and 2, J. Wiley & sons, Chichester, 1989.
4. T. W. Hungerford, Algebra Springer-Verlag, New York, 1974.
5. N. Jacobson, Basic algebra, vols. I and II, Freeman and Co., San Francisco, 1985.

Additional reading

1. E. Artin, Galois theory, University of Notre Dame Press, London, 1985.
2. E. Galois, Oeuvres Mathématiques. Publiées en 1846 dans le Journal de Liouville, Editions Jacques Gabay, Paris, 1989.