Universidad Zaragoza

Year : 2020/21

27017 - Galois Theory

Syllabus Information

Academic Year: 2020/21
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

This is a compulsory subject in the Degree of Mathematics of the University of Zaragoza.

Its main aim is to introduce the students to the basic aspects of Group Theory and of 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.

Inside the syllabus, it corresponds to the algebraic structures module. The student is advised to have completed the second year subject Algebraic Structures before enroling in this one.

1.3.Recommendations to take this course

Regular attendance is strongly recommended. Also, the students is expected to particpate actively in the classes, to make use of the office hours to get a better understanding of the subject and also to work regularly on the exercises and problem sheets. The content learnt in the subject Algebraic Structures will be very much used so the student is advised to have completed that subject before enroling in this one.

Work in groups and active discussions in class will be incentivated.

2.Learning goals

2.1.Competences

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

- Reason in an abstract way.
- Be able to write and communicate abstract concepts of Mathematics.
- Be able of autonomous learning.

2.2.Learning goals

To complete this subject, the student must be able of:

Make computations in some particular groups (cyclic, dihedral, symmetric of small degree) and rings (of numbers, polynomials ans 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 Galois correspondence and in particular know the characterization of solvability by radicals of polynomial equations.

2.3.Importance of learning goals

It is a basic part of the syllabus of the Maths Degree. Moreover, Group Theory is an important tool in every branch of mathematics.

3.Assessment (1st and 2nd call)

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

To complete the subject, students will be required to show competence in the required learning goals by means of the following activities.

There will be written individual exercises sets E1, E2, E3, E4 that will be graded with a maximun of 10 points each.

Sets E1, E2, E4 will deal with particular subsections of the subject and will be performed in October, November and January. Students will be given around one hour to complete them.

Set E3 will be comprehensive of everything that has been seen in class untill then. It will be performed in December.

All the details about these exercises sets will be anounced in Moodle.

Each student will get a continuous evaluation mark that will be the maximun between 0.1E1+0.1E2+0.6E3+0.2E4 and 0.8E3+0.2E4.

To pass the subject, it will be required to get at least 5 points in both the set E4 and the continuous evaluation mark.

The final mark will be the maximum between the continuos evaluation mark and the mark of the comprehensive final exam (taking this last one as zero if the student did not attend the final exam).?

Alternatively, students are given the option to have a comprehensive final exam.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

There will be theory classes with a lot of examples and exercises proposed to students. Teachers will encourage students to participate and to work together to increase both their mathematical communication skills and their ability for abstract reasoning. There will be some group exercises but grading will be based on personal work only. Students will be able and encouaged to attend office hours.

Written notes, exercise sheets will be available in Moodle.

4.2.Learning tasks

Lessons will follow the written notes available for students in Moodle. Proofs will be expanded with details and examples. There will be plently of problem solving, including a detailed solving of the written individual exercises sets used for the grading and also group problem solving.

Classes and evaluation will be in person unless the current sanitary situation makes it necessary to move to on-line teaching. This will be determined in any case by the health authority and the University of Zaragoza.

4.3.Syllabus

This course will address the following topics:

- Groups: basic notions
- Groups of permutations
- Group actions
- Structure of finite groups
- Field extensions. Algebraic extensions
- Splitting extensions. Extensions of homomorphisms
- Normal extensions. The Galois group
- The Galois Theorem
- Solvable groups. Solving equations by radicals

4.4.Course planning and calendar

There will be four weekly lecture hours. Theoretical and practical parts will not be separated in advance. Exercises and problems, similar to those in the individual written exercises sets will be proposed and discussed. That discussion will also include office hours.?

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 via Moodle. Date of the comprehensive exam will be determined and made public by the Faculty of Science. For any other question or requirement, students are recommended to contact teachers by email.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=27017&year=2020