Course guide
200246 - AABS - Abstract Algebra

Last modified: 01/06/2023

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JOSEP ALVAREZ MONTANER

Others: Primer quadrimestre:
JOSEP ALVAREZ MONTANER - M-A

PRIOR SKILLS

Minimal concepts of algebra, structures, substructures, homomorphisms. Abilities learned in the Fundamentals of Mathematics and Algebraic Structures subjects are perfectly adequate.

REQUIREMENTS

Even though it would not be strictly necessary, it is highly recommended to have previously studied the subject of Algebraic Structures.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
GM-CE2. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
GM-CE4. CE-4. Have the ability to use computational tools as an aid to mathematical processes.
GM-CE6. Ability to solve problems from academic, technical, financial and social fields through mathematical methods.

Generical:
GM-CB5. To have developed those learning skills necessary to undertake further interdisciplinary studies with a high degree of autonomy in scientific disciplines in which Mathematics have a significant role.
GM-CG1. CG-1. Show knowledge and proficiency in the use of mathematical language.
GM-CB4. CB-4. Have the ability to communicate their conclusions, and the knowledge and rationale underpinning these to specialist and non-specialist audiences clearly and unambiguously.
GM-CG2. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
GM-CG3. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
GM-CG4. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
GM-CG6. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

Two weekly hours, with lecture and problems combined. There will be problems to submit and be corrected.

LEARNING OBJECTIVES OF THE SUBJECT

Introduction to modules. Classification of abelian groups.
Basic concepts of nonabelian groups.

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours small group	15,0	20.00
Hours large group	15,0	20.00

Total learning time: 75 h

CONTENTS

Introduction to module theory

Description:
Introduction to modules over a commutative ring. Free and torsion modules. Linear algebra over rings. Classification of finitely generated abelian groups.

Full-or-part-time: 37h 30m
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study : 22h 30m

basic concepts of nonabelian groups

Description:
Nonabelian groups. Subgroups and normal subgroups. Cosets and quotients. Cayley graphs and Schreier graphs. Important subgroups: commutator, centralizers, center. Abelianization, nilpotent and solvable groups. Conjugation and normalizer of a subgroup. Automorphisms and characteristic subgroups.

Full-or-part-time: 37h 30m
Theory classes: 7h 30m
Laboratory classes: 7h 30m
Self study : 22h 30m

GRADING SYSTEM

The submitted problems will be evaluated and will count up to a 60% of the final grading. For the rest there will be a final exam but, in the case of small groups, it may be replaced with a directed work related to the course.

BIBLIOGRAPHY

Basic:
- Rotman, Joseph J. An Introduction to the theory of groups. 4th ed. New York [etc.]: Springer, cop. 1995. ISBN 0387942858.
- Stillwell, John. Classical topology and combinatorial group theory. 2nd ed. New York: Springer-Verlag, cop. 1993. ISBN 0387979700.
- Lyndon, Roger C; Schupp, Paul E. Combinatorial group theory. Berlin: Springer, 1977. ISBN 9783540411581.
- Bogopolskij, Oleg Vladimirovic. Introduction to group theory. Zürich: European Mathematical Society, cop. 2008. ISBN 9783037190418.