Faculty of Science

MATC31, Mathematics: Algebraic Structures, 7.5 credits

Matematik: Algebraiska strukturer, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2024-05-22. The syllabus comes into effect 2024-05-22 and is valid from the spring semester 2025.

General information

The course is an elective course for first-cycle studies for a Bachelor's of Science degree in mathematics.

Language of instruction: English

Main field of study	*Specialisation*
Mathematics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The overarching goal of the course is for the students to acquire knowledge of the basic concepts and structures in abstract algebra such as groups, rings and fields, which are of importance for further studies in mathematics as well as in applications in computer science, information theory, physics and chemistry. The aim is further to develop the students' ability to solve problems and to absorb mathematical text.

Knowledge and understanding

After completing the course the student should be able to:

- give an account, in writing and orally, of the content of the central definitions, theorems and proofs covered in the course
- account for basic properties of the concepts ring, ideal, quotient ring, group and field, important in abstract algebra

- give examples of and illustrate some areas of application important for the content of the course.

Competence and skills

After completing the course, the student should be able to:

- integrate knowledge from the different parts of the course in connection with problem solving,
- independently identify problems that can be solved by methods that are part of the course and use appropriate solution methods
- independently use the theory within the framework of the course content to solve problems of a proof nature
- plan and carry out assignments relevant to the course using appropriate methods within a given time frame
- explain the solution to a mathematical problem within the framework of the course, in speech and in writing, logically coherently and with adequate terminology.

Judgement and approach

After completing the course, the student should be able to:

- argue for the importance of group theory and ring theory as tools in other areas such as Galois theory and algebraic number theory and discuss their limitations.

Course content

The course treats:

- Number theory: the fundamental theorem of arithmetic, modular artithmetic.
- Groups: definition, basic examples of groups, subgroups, normal subgroups, factor groups, isomorphisms and homomorphisms, Lagrange's theorem, permutation groups, symmetric and alternating groups, finitely generated Abelian groups.
- Rings: definition, basic examples of rings, isomorphisms and homomorphisms, ideals, factor rings, polynomial rings, factorisation of polynomials as products of irreducible poynomials.
- Fields: characteristic, simple field extensions, finite fields.

Course design

The teaching consists of lectures and seminars. A compulsory written assignment is part of the course.

Assessment

The examination consists of a written examination followed by an oral examination at the end of the course, as well as a written presentation of a problem assignment during the course. The oral examination may only be taken by those students who pass the written examination. Students who fail the regular examination are offered a re-examination shortly thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction
The grading scale for all examination parts is Pass, Fail.

To pass the course it is required to pass the written examination, the oral examination and the written problem assignment. In addition, the grade Pass with distinction requires that the total number of points obtained in the written and the oral examination is at least 75% of the total maximal number of points. The maximal number of points that can be obtained in the written and the oral examination are weighted three to one.

Entry requirements

For admission to the course, English 6 is required and at least 60 credits in Natural Science or Engineering studies, of which at least 30 credits in mathematics, including the courses MATA32 Algebra and Vector Geometry, 7.5 credits and MATB32 Linear algebra, 7.5 credits or equivalent courses.

Further information

The course may not be included in a higher education qualification together with the course MATM31 Algebraic structures, 7.5 credits.

The course is to be studied together with FMNN10 Algebraic Structures, which is coordinated by the Faculty of Engineering, Lund University.

The course is given at the Centre for Mathematical Sciences, Lund University.