



*Course syllabus*

# Algebraiska strukturer Algebraic Structures

**FMAN10, 7,5 credits, A (Second Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED F/Pi

**Date of Decision:** 2023-04-18

## General Information

**Elective for:** C4-sec, D4, F4, Pi4-pv

**Language of instruction:** The course will be given in English on demand

## Aim

The aim of the course is to give an introduction to the fundamental concepts and structures of abstract algebra, with particular regard to subjects of importance in applications in, e.g., computer science, information theory, physics and chemistry. The course also aims to give a deeper understanding of the basic concepts in other areas of mathematics. Furthermore, the course should develop the students' ability to solve problems and to understand mathematical text.

## Learning outcomes

*Knowledge and understanding*

For a passing grade the student must

- be able to describe basic properties of integers and polynomials, and be able to compute with congruences modulo these objects.
- be able to describe basic properties of important concepts in abstract algebra; ring, ideal, quotient ring, group and field.
- be able to explain, in writing and orally, the contents of some central definitions and proofs.
- be able to give examples of and illustrate some important applications of the course contents.
- have acquired basic knowledge for further studies in algebra or subjects based on algebraic methods.

### *Competences and skills*

For a passing grade the student must

- be able to independently construct proofs of simple statements within the framework of the course.
- be able to show a good ability to independently, in writing and orally, explain mathematical reasoning in a well structured way, with clear logic.

## Contents

*Number theory:* The fundamental theorem of arithmetic, modular arithmetic.

*Rings:* Definition and basic properties. Polynomial rings. Ideals and quotient rings. Ring homomorphisms and isomorphisms.

*Groups:* Definition and basic properties. Normal subgroups and quotient groups. Group homomorphisms and isomorphisms. Lagrange's theorem. Permutation groups. Symmetric and alternatic groups. Finitely generated Abelian groups.

*Fields:* Characteristic. Finite fields. Field extensions.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** Written examination followed, for those who pass, by an oral examination.

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.

## Admission

**Assumed prior knowledge:** In terms of content, the courses in Calculus and Linear algebra are sufficient. However, the greater mathematical maturity provided by one or more further courses in mathematics is helpful.

**The number of participants is limited to:** No

**The course overlaps following course/s:** FMA190, MATM11, MATM31

## Reading list

- Hungerford, T W: Abstract Algebra, An Introduction. Brooks/Cole, 2012, ISBN: 9781111573331. 3rd edition. Since this edition is very expensive the literature may be changed. Otherwise the 2nd edition may be used.

## Contact and other information

**Course coordinator:** Studierektor Anders Holst, [Studierektor@math.lth.se](mailto:Studierektor@math.lth.se)

**Course coordinator:** Studerandeexpeditionen, [expedition@math.lth.se](mailto:expedition@math.lth.se)

**Teacher:** Magnus Goffeng, [Magnus.Goffeng@math.lth.se](mailto:Magnus.Goffeng@math.lth.se)

**Course homepage:** <https://canvas.education.lu.se/courses/20590>