EPFL

MATH-310   **Algebra**

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Cursus	Sem.	Type
Chemistry	BA5	Obl.
Communication systems	BA5	Obl.
Computer science	BA5	Opt.
Cyber security minor	H	Opt.
HES -SC	H	Obl.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Study basic concepts of modern algebra: groups, rings, fields.

Content

- Algebraic structures: sets, groups, rings, fields.
- Groups. Subgroups. Homomorphisms of groups, normal subgroups, quotients. Cyclic groups, permutation groups. Structure of finite abelian groups.
- Rings. Homomorphisms of rings. Ideals, principal, prime and maximal ideals, principal rings, factorial rings. Quotient rings. The Chinese remainder theorem.
- Examples of rings. Integers. basic properties. Euler's and Fermat's theorems. Polynomial rings. GCD, unique factorization.
- Fields. Algebraic extensions. Finite fields. Primitive elements.

Keywords

Group, homomorphism, subgroup, normal subgroup, quotient group, cyclic group, symmetric group, order of the group, order of an element, ring, ideal, principal ideal, prime ideal, maximal ideal, unique factorization, Euler's totient function, principal ring, factorial ring, field, finite field, field extension, characteristic of a field, primitive element of a finite field.

Learning Prerequisites

Required courses

Linear Algebra I, Analyse I

Recommended courses

Linear Algebra I, Analyse I, Analyse II

Learning Outcomes

By the end of the course, the student must be able to:
- Apply concepts and ideas of the course
- Reason rigorously using the notions of the course
- Choose an appropriate method to solve problems
- Identify the concepts relevant to each problem
- Apply concepts to solve problems similar to the examples shown in the course and in problem sets
- Solve new problems using the ideas of the course

• Implement appropriate methods to investigate the structure of a given group, ring or field, and study their properties

Teaching methods

Lectures and exercise sessions

Assessment methods

Written exam

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

1. S. Lang, Undergraduate Algebra. Undergraduate texts in Mathematics. Springer-Verlag, Inc. New York, second edition, 1990.
2. L. Childs, A Concrete Introduction to Higher Algebra. Undergraduate texts in Mathematics, Springer-Verlag, Inc. New York, 1995.

Ressources en bibliothèque

• Abstract algebra /Dummit
• Undergraduate Algebra / Lang
• A Concrete Introduction to Higher Algebra / Childs