Algebra (Prof. Dr. Georg Illies)

Overview

The course deals with fundamental structures and concepts of algebra, that are the basis for many areas of mathematics as well as for a wide range of applications, especially in IT and communication sciences. The focus is on basic concepts in the theory of groups, rings, and fields.

Key Topics

1. **Group Theory:**
   - Definition and properties of groups and their homomorphisms.
   - Basic constructions of groups and examples.
   - Operations of groups on sets.
   - Applications of group theory to symmetry.

2. **Ring Theory:**
   - Definition and properties of rings and their homomorphisms.
   - Integral domains and principal ideal domains.
   - Univariate and multivariate polynomial rings.
   - Applications of polynomial rings in coding theory.

3. **Field Theory:**
   - Definition and properties of fields and field extensions.
   - Splitting fields.
   - Finite Fields.
   - Applications of Finite Fields in cryptography.
   - Outlook on Galois theory.

Learning goals: By the end of this course, students will:
- Understand the basic concepts of modern algebra.
- Be able to solve basic algebraic problems.
- Gain insight into some applications of algebraic concepts.
- Develop the ability to reduce concrete problems in application fields to algebraic structures and solution methods.
- Explore advanced topics like Galois theory, if covered.