האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM

The Hebrew University of Jerusalem

Syllabus

ALGEBRAIC STRUCTURES (2) - 80446

Last update 18-03-2025

HU Credits: *4*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Mathematics*

Academic year: *0*

Semester: *2nd Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Prof. Michael Temkin*

Coordinator Email: *michael.temkin@mail.huji.ac.il*

Coordinator Office Hours:

Teaching Staff:

Mr. Geva Yashfe,
Prof. Michael Temkin

Course/Module description:

In Algebraic Structures (I) you learned about groups as algebraic structures, as well as basic notions about rings. In the second semester we will mainly study the theory of fields, with the central topic being the Galois theory of finite extensions of fields.
We will start with generalizing the prime decomposition theorem of arithmetic to other rings, notably rings of polynomials. We will study further principal rings, and finitely generated modules over them. After that we will proceed to Galois theory, studying field extensions via their groups of automorphisms. As application, we will see the solution of ancient problems on solutions by radicals and construction by ruler and compass, and hopefully develop a feeling for the modern use of automorphism groups. Additional topics, including positive characteristic and applications to arithmetic, if time permits. The material is subject to change based on the course of learning in this class.

Course/Module aims:

Understanding the ideas above in a mathematically rigorous manner.

Learning outcomes - On successful completion of this module, students should be able to:

Fields and Galois theory

Attendance requirements(%):

Teaching arrangement and method of instruction: Lectures, exercises

Course/Module Content:

**Field extensions - algebraic and transcendental extensions. Degree of the extension and roots of polynomials.*
**Constructions with a ruler and a Compass.*
**Normal and separable extensions, splitting fields.*
**The algebraic closure and the degree of transcendence.*
**The Galois theory of finite extensions. Correspondence between subgroups and subfields.*

*Cyclic and cyclotomic extensions.
*Solving equations by roots.
*Finite fields.

Required Reading:
Lecture notes will be available on moodle

Additional Reading Material:
The book "Algebraic Structures" by De-Shalit, Lubotzky and Puder

Jacobson, Basic Algebra I
Dummit&Foote, Abstract Algebra

Grading Scheme:
Written / Oral / Practical Exam 90 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 10 %

Additional information:
Other or additional topics may be studied.