

## Modern Algebra 1: Commutative Algebra

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**Subject area:** Mathematics

<b>University:</b>	Technion
<b>Level:</b>	BA3, BA4, MA1
<b>Teaching mode:</b>	hybrid: some students participate online, other students attend real-life
<b>Instructor(s):</b>	Howard Nuer

### Short description

Commutative Rings: Ideals, Nilradical and Jacobson Radical. Modules, Exact Sequences, Tensor Products, Algebras. Quotient Rings and Quotient Modules. Primary Decomposition. Integral Extensions of Rings, Valuations. Chain Conditions. Noetherian Rings, Artinian Rings. Discrete Valuation Rings and Dedekind Domains. Completions of Rings. Dimension Theory.

### Full description

In this course we will cover the standard syllabus for a first course in commutative algebra with a view toward algebraic geometry, including: localization; the functors Hom and Tensor product; associated primes and primary decomposition; integral dependence and Hilbert's Nullstellensatz; the Artin-Rees Lemma; flatness and the local criterion for flatness; completions: the Cohen structure theorem and Hensel's lemma; and dimension theory: Krull's principal ideal theorem, normal rings, DVRs, Serre's criterion, the dimension of affine varieties and their coordinate rings, elimination theory, generic freeness, and the dimension of fibers. Throughout the course, the geometric meaning of algebraic concepts will be emphasized.

### Learning outcomes

A student completing the course in good standing will be able to understand the myriad of applications of commutative algebra throughout mathematics. Most importantly, the student will have the requisite background to study algebraic geometry, algebraic groups, algebraic number theory, in addition to going further in algebra itself.

### General information

**Contact hours per week:** 3

**Total workload:** 90 Hours (in student hours for the whole course)  
**ECTS credits:** 3  
**Language:** English

**Course start date:** 25 October 2022

**Course end date:** 26 January 2023

**Add. info about start date:**

**Weekly teaching day/time:**

**Time zone:** CET +1 (Estonia, Israel)

**Further information:** Please note that Technion does not work with ECTS. The amount of ECTS which you see in the description is meant to give an indication of the intensity of the course. However, the transcript of records will not be listing ECTS

**Prerequisites:** Introduction to Rings and Field, Groups, Rings, and Modules, Field Theory

**Activities and methods:** Lectures, Self-study, Exercises

**Presence on campus:**

## Final examination

**Form:** Take-home examination

**Date:**

**Location/format:**

**Re-sit possibility:**

**Transcript available:** on request

**Add. info/requirements:**

## Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

## Administration

**Number of places:**

**Minimum participants:**

**Internal course code:** 106380

**Contact:** Bat-el Almogy, [academic@int.technion.ac.il](mailto:academic@int.technion.ac.il)

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*This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit [www.euroteq.eu](http://www.euroteq.eu) or get in touch with the above-mentioned point of contact.*