GHENT UNIVERSITY

Course Specifications

From the academic year 2024-2025 up to and including the academic year

Algebra I (C003557)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 1)	Dutch	Gent	independent work	0.0h
			seminar	
			lecture	

Lecturers in academic year 2025-2026

De Medts, Tom	WE02	lecturer-in-charge

Offered in the following programmes in 2025-2026	**crdts**	**offering**
Bachelor of Science in Mathematics	6	A
Preparatory Course Master of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

rings, ideals, modules, unique factorization, abstract groups, permutation groups, Sylow theorems

Position of the course

Learn to understand abstract theories and learn how to produce abstract arguments. Consequently the theory is developed from the very beginning, including all basics and proofs. The student acquires knowledge of the fundamental notions and results in commutative ring theory and group theory. The aim is that the student learns to understand difficult proofs by distinguishing between the essential and side parts. Moreover, the student is encouraged to see and use connections with other courses.

This contributes to the following general aims of the education in Mathematics:
Presenting a wide range of basic mathematics to the bachelor.
Make the bachelor getting used to the specific ways of mathematical thinking, to the characteristic of strict arguing, and to the high level of abstraction.
Introduce the bachelor to the main areas in mathematics, in this case algebra.

Contents

Definitions, examples and basic properties of commutative rings, ideals and modules. Prime ideals and maximal ideals, Chinese remainder theorem. Principal ideal domains, Euclidean domains, unique factorization. Finitely generated modules over principal ideal domains.

Definitions, examples and basic properties of groups, subgroups, normal subgroups, quotient groups, isomorphism theorems. Characteristics of groups. Definitions, examples and basic properties of permutation groups. Transitivity, orbit-stabilizer formula. Basics of p-groups, Cauchy's theorem, Sylow theorems.

Initial competences

Final competences of the courses Discrete Mathematics II and Linear Algebra and Analytic Geometry I.

Final competences

1 The student is capable of abstract reasoning, and has developed some intuition

for algebraic abstraction. In particular, the student can deal with groups, rings and modules.
2 The student can solve problems for which there are no standard procedures or methods available.
3 The student knows how to apply elementary material from other courses to help solving problems in algebra.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture, Independent work

Extra information on the teaching methods

The theory is explained at the blackboard. The exercises are discussed in small groups. In this course, the principles of activating teaching and learning will be applied and an active contribution from the students will be encouraged.

Study material

Type: Syllabus

Name: Algebra I
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 129
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : Yes

References

- M. Aschbacher: Finite Group Theory, 2nd edition. Cambridge studies in advanced mathematics vol. 10 (2000).
- P.M. Cohn: Basic Algebra: Groups, Rings and Fields. Springer (2002).
- T.W. Hungerford: Algebra. Holt, Rinehardt and Winston, Inc. (1974).
- M. Isaacs: Finite Group Theory, AMS Graduate Studies in Mathematics vol. 92 (2008).

Course content-related study coaching

The teacher is always prepared to give additional explanation at any time. The students are encouraged to solve problems on paper and hand them in. They are graded as on the final exam. Each session, one such exercise is treated.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment

Examination methods in case of periodic assessment during the second examination period

Oral assessment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

Exercises: written exam, where the students are allowed to use the syllabus as well as their own notes. This allows the student to think quietly and to prove his/her ability in problem solving.
Theory: oral exam. The student has to prove some theorems at the blackboard, and discuss this with the teacher. This way, the student is tested on his/her insight in the matter rather than on his/her ability to memorize. Also, the communication

skills of the student are tested.
Report: the student will receive a task during the semester in which he/she has to report about topics actively discussed with other students.

Calculation of the examination mark

Theory and exercises each count for 45% of the total score and the report counts for 10% of the total score. In addition, however, a minimum of 25% is needed for each of these three parts separately in order to pass the course. If the student has a total score of 10/20 or higher but fails to meet these minimum requirements, then the score is lowered to 9/20.