GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Linear Algebra and Geometry II (C003555)

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

Credits 6.0 **Study time 165 h**

Course offerings and teaching methods in academic year 2025-2026

A (semester 2)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

Van Maldeghem, Hendrik	WE02	lecturer-in-charge

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

Teaching languages

Dutch

Keywords

Affine geometry, bilinear forms, quadratic forms, sesquilinear forms.

Position of the course

Affine geometry is a basic theory which is necessary for a good understanding of several courses in later years of the curriculum, such as the geometrical ones. This is also true for the theory of bilinear and sesquilinear forms. The interaction between geometry and linear algebra is at the centre of this course.
The structure of the course will stimulate the student to use an abstract mathematical way of thinking, without ignoring the applications in other disciplines.

Contents

The course consists of two parts. In the first part affine spaces are introduced axiomatically and we study parallelism, affine subspaces, basis, dimension and dilatations. Then we show the existence of translations and homotheties using Desargues' theorem. Assuming the Axiom of Pappus, we prove that the affine space can be given the structure of a vector space over a field, after choosing an arbitrary origin. At the end we study affine transformations, coordinatisation and ratio, and we introduce the linear groups.

In the second part, we treat the theory of bilinear and sesquilinear forms. We introduce the theory as much as possible viewing the bilinear forms as special cases of the sesquilinear forms. The emphasis is on reflexive forms, which lead to alternating and symmetric blinear forms, and on hermitian forms. Matrix representations and standard forms are treated and allow to study isometry groups such as the Euclidean group. At the same time also quadratic forms are studies, as much as possible independently of the characteristic of the field.

Initial competences

Foreknowledge from the course "Linear Algebra and Geometry I".

Final competences

1 The students master the theory of affine spaces and are able to argue starting from a limited set of axioms.
2 The students master the theory of bilinear and sesquilinear forms over arbitrary vector spaces.
3 The students are able to detect connections between the different parts of the course.

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

Extra information on the teaching methods

Theory: interactive lectures.
Exercises: in the exercise sessions the students try to solve the exercises under guidance. In these sessions the techniques are taught and examples that clarify the theory are given.

Study material

Type: Syllabus

Name: Linear algebra and geometry 2
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 88
Oldest Usable Edition : 2023–2024
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

Course content-related study coaching

Students can ask questions on the theory and the exercises before and after the lectures. This is also possible by appointment or by e-mail.

Assessment moments

end-of-term 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

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Theory: oral exam. Questions are directed to test the knowledge of the new concepts and their relations in the theory. One must be able to illustrate methods and concepts with examples. One must be able to explain the logical structure of the proofs and the underlying ideas, and to clarify them using examples. It is tested whether the student has enough insight in how the theory was built up, in the relations between various parts of the course, and the importance of the various parts in the chourse as a whole.
Exercises: oral exam on a blackboard. The student must show that he/she is able to apply to main techniques, and masters the arguments and proof methods of this field of study.

Calculation of the examination mark

To determine the final mark the following weighting factors are used: theory exam 50%, exercise exam 50%.