GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Projective Geometry (C000313)

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 1)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2025-2026

De Bruyn, Bart	WE01	lecturer-in-charge
Thas, Koen	WE01	co-lecturer

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

Vector spaces, affine spaces, projective spaces, collineations, polarities, conics, quadrics, hermitian curves, hermitian varieties, axiomatic projective spaces, axiomatic projective planes, exterior algebra, Klein correspondence, Plücker coordinates.

Position of the course

The students should apply their preknowledge on geometry from the courses Linear Algebra and Geometry to the study of projective spaces. The way of setting up the course will stimulate the student to be skilled in handling more abstract mathematical reasoning.

Contents

After giving a general definition of projective spaces over fields (including homogeneous coordinates, the theorems of Desargues and Pappus, collineations, correlations and perspectivities) a detailed study is given of projective lines over fields (isomorphisms between projective lines, cross ratio, the theorem of the complete 4-gon). After that a general study of polarities will be treated, including classification and standard forms, emphasizing the polarities in projective spaces over the reals, complex numbers and finite fields. The study of polarities in projective planes over fields give rise to conics and hermitian curves. These sets of points will be studied in detail. Also an axiomatic approach to the study of projective spaces will be discussed, as well as the so-called Klein correspondence. The last chapter of the course contains an axiomatic study of projective and affine planes; the desarguesian planes as well as some simple non-desarguesian planes will be discussed.

Initial competences

Final competences of the course Linear Algebra and Geometry II.

Final competences

1 The students will have a deep knowledge on projective geometry over fields.
2 The students will have a general knowledge on axiomatic projective spaces and planes.
3 The study of polarities in projective spaces and conics in projective planes is an important part of the course that can serve as a basis for a more advanced study

in other geometry courses.

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

The aim is a combination of ex-cathedra teaching and self-study, supported by the standard electronic educational tools.

Study material

Type: Syllabus

Name: Projective Geometry
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 101
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

Type: Syllabus

Name: Projective Planes
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 36
Available on Ufora : Yes
Online Available : No
Available in the Library : No

References

- R. Casse, *Projective Geometry: An Introduction*, Oxford Handbooks.
- J. W. P. Hirschfeld, *Projective Geometries over Finite Fields*, Oxford University Press.
- D. R. Hughes, F. C. Piper, *Projective Planes*, Graduate Texts in Mathematics 6, Springer-Verlag.
- A. Beutelspacher, U. Rosenbaum. *Projective Geometry: from foundations to applications*, Cambridge University Press.

Course content-related study coaching

Students can ask questions on the theory and the exercises before, during and after the lectures. This is also possible on appointment or by email.

Assessment moments

end-of-term assessment

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

Written assessment with open-ended questions

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

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

There will be a written exam on theory and exercises. The understanding, knowledge and skills are evaluated.

Calculation of the examination mark

Theory 12/20
Exercises 8/20