

## Galois Geometry (C003009)

**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	seminar
			lecture

**Lecturers in academic year 2025-2026**

Storme, Leo	WE16	lecturer-in-charge
D'haeseleer, Jozefien	WE16	co-lecturer

**Offered in the following programmes in 2025-2026**

	crdts	offering
Master of Science in Teaching in Science and Technology (main subject Mathematics)	6	A
Master of Science in Mathematics	6	A

**Teaching languages**

Dutch

**Keywords**

Incidence geometry, projective spaces, polar spaces, quadrics, Hermitian varieties, symplectic polar spaces, Grassmann coordinates, generalized quadrangles, ovoids, spreads

**Position of the course**

Basic course on classical polar spaces with emphasis on quadrics and Hermitian varieties, and with an introduction to (mainly finite) generalized quadrangles. The course is an advanced sequel to the course "Projective geometry", emphasizing classical varieties. Students acquire a high level of knowledge, and are introduced to geometry as a current and living scientific activity.

**Contents**

- 1 Quadrics: canonical forms, invariants, tangent spaces and polarity, generators and subgenerators, orthogonal groups.
- 2 Hermitian varieties: canonical form, tangent spaces and polarity, generators and subgenerators, unitary groups.
- 3 Symplectic polar spaces: canonical form, tangent spaces and polarity, generators and subgenerators, symplectic groups.
- 4 Grassmann coordinates and Grassmann varieties.
- 5 Ovoids and spreads of classical polar spaces.

**Initial competences**

The necessary background is contained in the courses Linear Algebra and Geometry I and II, Algebra I and Projective Geometry, taught in the bachelor mathematics.

**Final competences**

- 1 The students are familiar with the theory of classical polar spaces, and have a good knowledge of quadrics, Hermitian varieties and symplectic polar spaces.
- 2 They are also introduced to incidence geometry, and see the importance of classical varieties in this context.
- 3 When studying finite geometry, incidence geometry or coding theory, they can regularly use the contents of this 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**

The theory is presented at the blackboard during the theory lectures. Techniques to solve problems on classical polar spaces are presented during the exercise lectures, but the students also have to make exercises, under supervision.

#### **Study material**

Type: Syllabus

Name: Galois geometry

Indicative price: Free or paid by faculty

Optional: no

#### **References**

J.W.P. Hirschfeld & J.A. Thas: General Galois Geometries, Oxford University Press (1991).

S.E. Payne & J.A. Thas: Finite Generalized Quadrangles, Pitman, Boston (1984).

#### **Course content-related study coaching**

During the lectures, the theory is presented in great detail at the blackboard. More information can always be obtained during or after the lecture. During the exercise sessions, exercises related to the theory are solved, aimed at giving the students more insight in the matter. Assistant and professor are always prepared to help the students with any problem.

#### **Assessment moments**

end-of-term assessment

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

Oral assessment open-book, Written assessment with open-ended questions

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

Oral assessment open-book, 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**

During the theory exam, the lecturer determines whether the students master the theory and have obtained sufficient insight. The objective of the exercise exam is to determine whether the students are able to solve independently problems on classical polar spaces.

The theory is examined during an oral exam with written preparation. The exercise exam is a written exam.

#### **Calculation of the examination mark**

Theory and exercises both count for 50% of the total number of points.