GHENT UNIVERSITY

Course Specifications

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

Finite Geometry (C002337)

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

Credits 6.0 **Study time 165 h**

Course offerings in academic year 2025-2026

A (semester 2)	English	Gent

Lecturers in academic year 2025-2026

De Bruyn, Bart	WE02	lecturer-in-charge
Taranchuk, Vlad	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
Exchange Programme in Mathematics (master's level)	6	A

Teaching languages

English

Keywords

Projective geometry, affine geometry, polar spaces, dual polar spaces, near polygons, generalized polygons, strongly regular and distance-regular graphs, (semi)partial geometries, designs.

Position of the course

This elective course should be regarded as a folllow up of the courses in geometry in the bachelor years. The aim is to give an overview of the state of the art in this domain, and to show to the students the links with other fields in combinatorics such as algebraic graph theory and design theory.

Contents

1 *Designs.* Symmetric designs, constructions of designs from other designs, Mathieu designs, Bruck-Ryser-Chowla theorem, Steiner triple systems.
2 *Strongly regular and distance-regular graphs.* Definitions and easy examples, Bose-Mesner algebra and restrictions on the parameters, examples of strongly regular graphs from Galois geometry, the Krein conditions.
3 *Geometries of rank 2.* Polar and co-polar spaces, dual polar spaces, near polygons, partial and semi-partial geometries, generalized polygons.
4 *Substructures of projective spaces.* Caps, ovals, hyperovals, ovoids, unitals, maximal arcs.

Initial competences

Projective geometry

Final competences

1 To get acquainted with the most important classes of (finite) incidence geometries and their most important properties.
2 To get acquainted with the most important substructures of (finite) projective geometries and their most important properties.

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 worked out in detail during the lectures. During the exercise sessions, the students get hints. Complete solutions will always be provided at the end.

Study material

Type: Syllabus

Name: An introduction to Incidence Geometry
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Pages : 302
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

- T. Beth, D. Jungnickel and H. Lenz. *Design theory. Vol I + II.* Cambridge University Press (1999).
- B. De Bruyn. *Near polygons.* Birkhäuser Verlag (2006).
- F. De Clerck and H. Van Maldeghem. *Some classes of rank 2 geometries.* Hoofdstuk 10 in *Handbook of incidence geometry* (editor F. Buekenhout). North-Holland (1995).
- J. W. P. Hirschfeld. *Projective geometries over finite fields.* Oxford Science publications (1998).
- J. W. P. Hirschfeld. Finite projective spaces of three dimensions. Oxford University Press (1985).
- D. R. Hughes and F. C. Piper. *Design theory.* Cambridge University Press (1985).
- C. C. Lindner and C. A. Rodger. Design theory. CRC Press (1997).
- S. E. Payne and J. A. Thas. *Finite generalized quadrangles.* European Mathematical Society (2009).
- H. Van Maldeghem. Generalized polygons. Birkhäuser, 1998.

Course content-related study coaching

The lecturer is available to give explanation to the students regarding the theory and exercises. There is also interactive support through Ufora.

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

The exam consists of a number of theoretical questions and exercises. For the theory, the students are supposed to study certain parts of the lecture notes, and they will be tested about their knowledge of these parts. The exercises will test their insight into the theory.

Calculation of the examination mark

- 60% theory
- 40% exercises