

Topology and Metric Spaces (C003569)

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 2)	Dutch	Gent	seminar lecture
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Lecturers in academic year 2025-2026

Vernaeve, Hans	WE16	lecturer-in-charge
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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

Topology, metric spaces, applications to analysis, Lebesgue integration.

Position of the course

Starting from metric spaces, in this course an introduction is provided to general topology, one of the main areas of contemporary mathematics (the area containing anything that can be said in great generality about concepts such as "neighbourhood", "close to", "convergence"). Topology allows to transfer intuition related to these concepts to a number of areas and problems of great diversity. These concepts are then applied to function spaces, thus giving insight in a number of proof methods in analysis, in particular in the theory of Lebesgue integration.

Contents

- 1.1. Metrics, topological concepts in metric spaces, characterisation of topological properties (e.g. continuity) by means of open sets, constructions.
- 1.2. Topological spaces, topological concepts, constructions (subspaces, product spaces, quotient spaces), homeomorphisms, connectedness, compactness, compactifications.
- 1.3. Completeness in metric spaces, completions, metric and topological function spaces, compactness in these spaces: Arzela-Ascoli theorem, Tychonov theorem (without proof). Topological vector spaces.
2. Applications to analysis. Lebesgue measure and Lebesgue integration.

Initial competences

Final competences of the courses Analysis I and Analysis II.

Final competences

- 1 The student has insight in the fact that for analysis, the precise definition of a metric is less important than the topological structure of the space and understands why it is useful to know whether a property is topological.
- 2 The student has the insight that, because of the generality in which a common concept like continuity is defined, topology can be applied in a huge number of situations.
- 3 The student can prove elementary theorems from general topology (exercises without model approach).
- 4 The student understands the role of topology as a tool to prove theorems in analysis (a.o. using compactness and connectedness).

- 5 The student fluently understands the language of topology (which puts "open sets" as a central notion) in reasonings, and can connect it with intuitive notions of neighbourhoods, limits, continuity as used in analysis.
- 6 The student understands the refinement of the theory of integration by Lebesgue and understands that this gives rise to practical conditions under which limit and integral may be interchanged.
- 7 The student can prove elementary theorems from measure and integration theory (exercises without model approach).

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

During the exercise sessions it is shown how the abstract theory can be applied as well in abstract situations as on more concrete examples; the emphasis is on the precise and correct handling of logical deductions and developing problem solving techniques.

Study material

Type: Syllabus

Name: Topology and metric spaces (in Dutch)
 Indicative price: Free or paid by faculty
 Optional: no
 Language : Dutch
 Number of Pages : 165
 Oldest Usable Edition : 2023-2024
 Available on Ufora : Yes
 Online Available : Yes
 Available in the Library : No
 Available through Student Association : No
 Additional information: PDF file, free to be used and printed

References

Course content-related study coaching

The lecturer is available for answering individual questions, also outside of the lecture periods (on appointment). Students can also have their independently solved exercises corrected.

Assessment moments

end-of-term assessment

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

Oral assessment, Written assessment

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

Oral assessment, Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

The theory part of the exam is a written examination in which it is tested whether the student has insightfully acquired and absorbed the material sufficiently; for this part, an oral explanation may be installed. The exercise part of the exam is a written open book examination.

Calculation of the examination mark

Periodic evaluation 100%

Theory and exercises each count for 50% of the total score; in addition, however,

(Approved)

a minimum of 2/10 for the exercises is needed to pass the course.