GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Banach Spaces and Banach Algebras (C003012)

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

Vernaeve, Hans	WE16	lecturer-in-charge
Chatzakou, Marianna	WE16	co-lecturer
Rana, Tapendu	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

Banach spaces, Banach algebras, C*-algebras

Position of the course

In this course, abstract analysis is developed more deeply. In the bachelor courses, metric spaces and Hilbert spaces were covered. Banach spaces were treated to a less extent. A lot of vector spaces of (generalized) functions, linear operators, ... in analysis are Banach spaces which aren't Hilbert spaces. Moreover, they often are Banach algebras (and even C*-algebras) for mutliplication. The course also aims to provide a preparation for research on (generalized) functions and operators and to generalizations in the theory of topological vector spaces (course Functional Analysis).

Contents

1. Banach spaces, linear operators on Banach spaces, dual spaces, weak topology, Hahn-Banach and Banach-Alaoglu theorem, reflexivity
2. Representation of separable normed spaces as spaces of continuous mappings
3. Baire and Banach-Steinhaus theorems, Open mapping and closed graph theorems
4. Banach algebras, spectrum, Gelfand-Mazur theorem
5. Commutative Banach algebras and C*-algebras, Banach algebras of continuous maps on a topological space, Gelfand-Naimark representation theorem, Stone-Weierstrass theorem. Application: Wiener's Tauberian theorem
6. non-commutative C*-algebras, functional calculus, algebras of boundend linear operators on a Hilbert space, spectral theorems.
7. Optional topics: Stone-Cech-compactification, GNS-construction, introduction to topological vector spaces, regular Banach algebras.

Initial competences

The student has successfully completed the course "Topology and metric spaces" or has acquired the final competences of this course in another way.
Familiarity with analysis in one complex variable and Hilbert spaces is also assumed.

Final competences

1 The student has insight in how the abstract Banach space and Banach algebra theory relates to a number of abstract concepts in analysis from the courses mentioned in the initial competences.
2 The student understands how Banach space and Banach algebra theory is useful in concrete situations in analysis (such as algebras of functions or linear operators).
3 The student understands how algebra and analysis contribute to a theory which would have a much more technical character when only one of the building blocks were used.
4 The student understands how a number of concepts in Banach space theory are developed as tools to compensate the lack of local compactness in finite dimensional vector spaces.
5 The student understands how a number of concpets in Banach space theory are developed as tools to compensate the lack of an inner product in Hilbert spaces.

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

Study material

Type: Syllabus

Name: Banach spaces and Banach algebras (in Dutch)
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Number of Pages : 100
Oldest Usable Edition : 2020-2021
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

R. Kadison and J. Ringrose, Fundamentals of the theory of Operator Algebras, vol. 1, Elementary theory, Academic Press, 1983.
W. Rudin, Functional Analysis, McGraw-Hill, 1973.

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

examination during the second examination period is possible

Extra information on the examination methods

Exercises: open book examination

Calculation of the examination mark

100% periodic evaluation.