

Funktional Analysis, 5 course credits

Funktionalanalys, 5 högskolepoäng

Course code:	FOUK025
Third-cycle subject:	Mathematics/Applied Mathematics
School:	School of Education, Culture and Communication
Valid from:	24H
Established by:	Dean of the School
Decision date:	2024-03-12
Last modified:	--
Level of education:	Third cycle level
Language	Swedish and English
English version	Yes

Course objective

The course aims to equip doctoral students with an understanding of the theory and methods in mathematical analysis, with a specific emphasis on functional analysis and its application areas.

Course content

- *Metric spaces*: basis, topology, completeness, compactness.
- *Normed spaces*: linear operators and functionals, dual spaces and reflexivity, Hahn-Banach theorem, dual maps, projections, L_p spaces.
- *Hilbert spaces*: Orthonormal systems, Riesz representation theorem.
- *Compact operators*: the Fredholm alternative.
- *Sobolev spaces*: test functions, weak derivatives, Sobolev's imbedding theorem.

Intended learning outcomes

After passing the course the doctoral student should be able to

1. Apply reasoning and techniques used in theorems and proofs to solve a given selection of problems.
2. Prove and apply a given selection of the course's key theorems.
3. Demonstrate understanding by combining the use of concepts, theorems, and experiences from examples, as well as ability to identify analogies and generalize within the field.

The intended qualitative targets in relation to the Higher Education Ordinance, appendix 2.

Knowledge and understanding

For the Degree of Doctor, the doctoral student shall demonstrate:

- A1: broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- A2: familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the Degree of Doctor, the doctoral student shall demonstrate:

- B1: the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues, and situations autonomously and critically,
- B2: the ability to identify and formulate issues with scholarly precision critically, autonomously, and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work,
- B4: the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general,
- B5: the ability to identify the need for further knowledge.

Teaching formats

Lectures and seminars.

Examination

SEM1, Seminar, 1 credit, oral performance of selected theoretical section, concerning learning outcomes 2-3, grades Fail (U) or Pass (G).

MUN1, Oral examination, 2.5 credits, oral presentation concerning learning outcome 1-3, grades Fail (U) or Pass (G).

INL1, Written assignment, 1.5 credits, assignment concerning learning outcome 1-3, grades Fail (U) or Pass (G).

Grade

Two-grade scale, fail or pass.

Requirements

Doctoral student.

Selection criteria

1. Doctoral students in mathematics/applied mathematics at Mälardalen University
2. Doctoral students at Mälardalen University
3. Doctoral students at other universities in Sweden
4. Doctoral students at higher education institutions outside Sweden