

# Functional Analysis

Programme course

6 credits

Funktionalanalys

TATM85

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

## Main field of study

Mathematics, Applied Mathematics

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Mathematics, Master's Programme
- Applied Physics and Electrical Engineering, M Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Linear Algebra, Calculus in one variable, Calculus in several variables, Real Analysis Honours Course, is a good preparation, but is not a prerequisite.

## Intended learning outcomes

To give familiarity with the fundamental concepts of functional analysis and to prepare the student for further studies in mathematics and related areas. After completing this course the student is able to:

- Describe the concepts of a metric space, vector space, subspace, normed space, Banach space, Hilbert space and dual space.
- Describe the logical connections between important concepts in the spaces mentioned above.
- Describe and apply central theorems in the theory of metric spaces, normed spaces, Banach spaces and Hilbert spaces.
- Apply Banach's fix point theorem in the theory of differential and integral equations.
- Describe the spectral theory for compact self adjoint operators
- Describe the Lebesgue integral and apply central theorems in the theory of the Lebesgue integral in order to solve problems.

## Course content

Elementary metric space theory. Normed spaces, Banach spaces, Hilbert spaces. Linear functionals, dual spaces. Linear operators. Aspects of the Lebesgue integral. Integral equations. Introduction to spectral theory for compact, symmetric operators.

## Teaching and working methods

Lectures

The course runs over the entire autumn semester.

## Examination

UPG1	Assignments	6 credits	U, 3, 4, 5
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## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: Partial differential equations, Fourier and Wavelet Analysis

## Department

Matematiska institutionen

## Director of Studies or equivalent

Jesper Thorén

## Examiner

Bengt Ove Turesson

## Course website and other links

[www.mai.liu.se/und/kurser/index-amne-tm.html](http://www.mai.liu.se/und/kurser/index-amne-tm.html)

## Education components

Preliminary scheduled hours: 60 h

Recommended self-study hours: 100 h

## Course literature

### Additional literature

#### Books

Kreyszig, E, (1981) *Introductory Functional Analysis with Applications*

#### Compendia

#### Other

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).