

# **Fourier Analysis**

Programme course

6 credits

Fourieranalys

**TATA77** 

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, Electrical Engineering, Applied Physics, Biomedical Engineering

#### Course level

First cycle

## Advancement level

G<sub>2</sub>F

## Course offered for

- Applied Physics and Electrical Engineering, M Sc in Engineering
- Mathematics
- Information Technology, 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**

Calculus (one and several variables), Linear Algebra and Complex analysis or equivalent.

## Intended learning outcomes

The course covers Fourier series as well as Fourier, Laplace and z-transforms in a unified treatment based on the foundations of distribution theory and complex analysis. It will give mathematical knowledge fundamental for treatment of problems in system engineering and physics. It is also a preparation for courses in partial differential equations. After a completed course, the student will be able to:

- Differentiate, integrate and transform distributions in one variable with particular emphasis on the Dirac distribution and its derivatives.
- Calculate Fourier series for simple periodic functions and distributions and determine convergence properties and estimate approximation errors in the mean.
- Solve linear differential equations with constant coefficients using distributions and Fourier- and Laplace transforms and linear difference equations using z-transforms.
- Using the complex inversion integral, in combination with residue calculus, to calculate inverse Laplace and z-transforms.



#### Course content

Basic distribution theory in one variable. Basic properties of Fourier series, Fourier, Laplace and z-transforms. Convergence of Fourier series, point wise and in the mean. Parseval's formula. Integrals with a parameter. The Fourier transform. The inversion formula. Rules of manipulation. The convolution formula. Parseval's formula. Inversion formulas and their validity. Convolutions and their transforms. Transforms of distributions. Applications to engineering and science.

# Teaching and working methods

Lectures, problem classes.

## Examination

TEN1 Written examination 6 credits U, 3, 4, 5

## Grades

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

## Department

Matematiska institutionen

## Director of Studies or equivalent

Jesper Thorén

#### **Examiner**

**Mats Aigner** 

#### Course website and other links

http://www.mai.liu.se/und/kurser/index-amne-tm.html

## **Education components**

Preliminary scheduled hours: 62 h Recommended self-study hours: 98 h



# Course literature

**Additional literature** 

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://styrdokument.liu.se/Regelsamling/Innehall/Utbildning\_pa\_grund\_och\_avancerad\_niva.

