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

G2F

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.