Fourier and Wavelet Analysis

Programme course

6 credits

Fourier- och waveletanalys

TATA66

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

Specific information
The course is only offered every second year. It will not be offered during 2017.

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, Caculus in one and severel variables, Fourier Analysis or Transform Theory

Intended learning outcomes
To give the student a deeper understanding of Fourier analysis and to give a theoretical background to wavelets and applications in signal processing. The student should reach good comprehension in the following fields.

- Basic Hilbert space theory
- Fourier series and the Fourier transform
- The theory of distributions
- Multiresolution analysis (MRA)
- Some commonly used wavelet systems

Course content

Introduction to the Lebesgue integral. Hilbert spaces: Inner products, orthogonal projection, convergence, completeness, orthonormal systems, orthonormal bases. Fourier series: Convergence theorems, Parseval's identity. The Fourier transform: Basic properties, inversion, Plancherel's identity, the Schwartz class. Distributions: Operations on distributions, tempered distributions, the Fourier transform, convolutions, periodic distributions, the Poisson summation formula, the sampling theorem. Wavelets: The Haar system, MRA (multiresolutional analysis), the Shannon wavelet, Meyer's wavelets, and wavelets with compact support, e.g., Daubechies' wavelets. Applications to differential equations and filter theory.

Teaching and working methods

Lectures.
The course runs over the entire spring semester.

Examination

UPG1	Written assignments	6 credits	U, 3, 4, 5

Grades

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

Department

Matematiska institutionen

Director of Studies or equivalent

Göran Forsling

Examiner

Bengt Ove Turesson

Course website and other links

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

Education components

Preliminary scheduled hours: 36 h
Recommended self-study hours: 124 h

Course literature

C. Gasquet, P. Witomski: Fourier Analysis and Application. Filtering, Numerical Computation, Wavelets, Springer-Verlag, 1998.
Utdelat material

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.