# SF2705 Fourier Analysis 7.5 credits

## Fourieranalys

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

## Establishment

Course syllabus for SF2705 valid from Spring 2016

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

Second cycle

## Main field of study

Mathematics

## Specific prerequisites

Courses corresponding to SF2713 Foundations of Analysis and SF1628 Complex Analysis.

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

A student who passed the course is expected to have the following skills:

- to define and to compute Fourier series/integrals; to formulate criteria for their pointwise convergence and convergence in $L^2$;
- to formulate how the Fourier series/integrals can be summed up in the sense of Cesaro and Abel;
- to formulate the properties of convolutions in the periodic case and on the whole line: convolution as a regularization; partial sums and integrals as convolutions etc;
- to formulate uniqueness properties of Fourier series/integrals and theorems of Parseval and Plancherel;
- to use the Fourier method for solving the heat conduction equation and wave equation in one variable; to solve the Dirichlet problem for Laplaces equation in the unit disk and the half-plane;
- to formulate properties of Hardy functions in the unit disk and the half-plane; to know Paley-Wiener theorem;
- to formulate how to apply Fourier analysis to other topics such as isoperimetric inequality and Heisenberg uncertainty principle;
- to know the Poisson summation formula;
- to formulate basic ideas of Fourier analysis in several dimensions and on discrete Abelian groups.

## Course contents

Fourier series and integrals in one variable.

Convergence properties: pointwise convergence, convergence in $L^2$, summation of Fourier series and integrals. The operations of convolution and Fourier series/integrals. Theorems of Parseval and Plancherel. Fourier analysis of analytic functions: Hardy functions in the unit disk and the half-plane, theorem of Paley-Wiener, the Poisson summation formula.

Applications: heat conduction equation; string equation; isoperimetric inequality; Laplaces equation in the unit disk and a half-plane; prime number theorem; Heisenberg uncertainty principle. Basic discussion of the Fourier analysis in several dimensions and on discrete Abelian groups.

## Course literature

Dym, McKean “Fourier Series and Integrals”. Academic Press, 1985.

## Examination

- TEN1 - Examination, 7.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

## Other requirements for final grade

Written and/or oral exam, with the possibility of continuous examination.

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.