SK2340 Fourier optics 6.0 credits

Fourieroptik

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 SK2340 valid from Spring 2016

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics,Physics

Language of instruction

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

Intended learning outcomes

The overall aim of the course is that you should be able to analyze optical problems with the help of the approximations made in Fourier optics. This means that you should be able to:

- Describe the mathematical characteristics of the two dimensional Fourier transform and explain their relevance for the analysis of linear optical systems
- Explain the basics of scalar diffraction theory
- Analyze different solution methods for the Helmholtz equation
- Apply the Fresnel and Fraunhofer approximation to calculate the diffraction patterns of standard optical components
- Reflect on the physical implications of diffraction and their influence on the resolution in optical imaging systems

Course contents

- 2-dimensional Fourier transform, discrete Fourier transform
- Foundations of scalar diffraction theory
- Kirchhoff and Rayleigh-Sommerfeld diffraction theories
- Fresnel and Fraunhofer diffraction
- Wave-optics analysis of coherent systems
- Frequency analysis of optical imaging systems
- Image processing

Specific prerequisites

Knowledge of the physics of electromagnetic radiation (SK1120 Waves, 6 hp or corresponding) and in basic mathematics (vector analysis, integrals, differential equations).

Recommended previous knowledge:
Knowledge in optics (SK2300 Optical physics, 6 hp or equivalent) is of advantage, but not mandatory. Basic knowledge of programming in MATLAB is highly recommended, but maybe acquired during the course.

Course literature

Joseph W. Goodman, Introduction to Fourier Optics, Third edition (2004), Roberts and Company publishers

En av de bästa böckerna inom optisk fysik, passar både för självstudier och för referens.

Joseph W. Goodman, Introduction to Fourier Optics, Third edition (2004), Roberts and Company publishers.

One of the best books in optical physics, suitable for both self-studies and as reference.

Examination

- LAB1 - Laboratory, 2.0 credits, grading scale: P, F
- PRO1 - Project, 4.0 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.

LAB1: Computer labs, Grade P/F

PRO1: Project presentation, Grade A-F

Other requirements for final grade

To pass the course you have to pass the lab and the project presentation (simulation of an optical system with Fourier optics).

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.