Course syllabus

Nanoteknikens matematiska metoder
Mathematical Methods of Nanotechnology

FMFF20, 7,5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED N
Date of Decision: 2023-04-17

General Information

Main field: Technology.
Compulsory for: N2
Language of instruction: The course will be given in Swedish

Aim

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- explain and describe basic properties of fourier series, fourier integrals and laplace transforms.
- qualitatively describe and explain applications based on fourier analysis such as image processing, heat conduction and analysis of linear mechanical and electrical systems.
- derive and describe Maxwells equations and explain their basic properties.

Competences and skills
For a passing grade the student must

- solve simpler exercises related to the central concepts of the course.
- with the help of computer simulations, analyze and visualize basic properties of models which are discussed during the course and present the analysis in a written report.

- carry out, analyze and present in a written report experimental laboratory work in central areas of the course.

Contents

From applications of physics and other parts of science, different mathematical and computational tools are introduced. Starting with specific problems, the methods are generalised and their universality is emphasized.

Mathematical tools that will be introduced are Fourier series and integrals, the Fourier transform, partial differential equations, equations of diffusion, linear systems, wave equation, Maxwell's equations, vector analysis and Laplace transform.

Applications of these tools are introduced through a number of projects. These could involve e.g. electrical circuits, networks, filters, harmonic signals, feedback systems, impedance, electromagnetism, diffusion, acoustics, musical instruments and mechanical systems.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Oral or written exam. Accepted laboratory work reports. Accepted computer laboratory work reports. Accepted excersise hand-ins.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: FMAB30 Calculus in Severable Variables, FAFA05 Physics - Waves, Thermodynamics and Atom Physics, Matlab.
The number of participants is limited to: No
The course overlaps following course/s: EXTF20, FFF155, EXTF65

Reading list

- The projects will be based on instructions produced at the department, L.Gislén.
- Jönsson, P.: Matlab, Studentlitteratur.

Contact and other information

Course coordinator: Gillis Carlsson, gillis.carlsson@matfys.lth.se
Course homepage: http://www.teorfys.lu.se/education/FMFF20
Further information: Some elements may be taught and assessed in English. This includes a maximum of 1.5 hp, in the form of laboratory sessions or written assignments.