FSK3700 Mesoscopic Physics 8.0 credits

Mesoskopisk fysik

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

Establishment

Course syllabus for FSK3700 valid from Autumn 2011

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

Basic courses in electro-magnetism and quantum mechanics are required. Basic course in solid state physics (Kittel level) is recommended.

Language of instruction

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

Intended learning outcomes

The goal of this course is to communicate a basic understanding of electron transport in systems that are “coherent” in the quantum mechanical sense. Description of actual exper-

iments and an overview of the research field is emphasized in the course. With a better understanding after the course you should be able to:

- Compare new the new concepts of nano-electronics with the present-day technique, and understand their fundamental limits,
- Use simple models to calculate the basic energy and length scales for mesoscopic phenomena which are physically relevant,
- Identify various basic device concepts in a variety of physics systems.

Course contents

Classical transport and diffusion, ballistic transport and conductance quantization, Landauer formalism and coherent transport, gauge invariant phase and Aharonov-Bhom effect, weak and strong localization, Coulomb blockade, Mesoscopic superconductors, decoherence of a quantum system in its environment. Nanoelectronics, Nanomechanics, experimental methods and demonstrations.

Course literature

- Supriyo Datta, Electron Transport in Mesoscopic Systems, Cambridge University Press.
- Scientific articles.

Examination

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.

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

- Assignments, 6.0 credits, grade scale: P/F
- Laboratory Work, 2.0 credits, grade scale: P, F

Other requirements for final grade

The examination will be through home project assignments and passed lab exercises.

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.