SK2755 Molecular Electronics 7.5 credits

Molekylär elektronik

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 SK2755 valid from Spring 2017

Grading scale

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

Education cycle

Second cycle

Main field of study

Engineering Physics

Language of instruction

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

Intended learning outcomes

The course treats the emerging field of molecular electronics from basics. Organic semiconductors will be an important introductory part of this course. The theory and practice of fabricating discrete and integrated molecular electronic devices and their applications in diverse fields will be covered. Means of achieving various electronics functionalities such as memory, logic etc. by the molecules will be treated. Lessons from biological molecular behaviour for molecular electronics will be addressed. Nanophotonics is also introduced as an integral part of molecular electronics.

After the course the student should be able to:

- Understand the physics behind organic semiconductors
- Calculate transport properties in the mesoscopic systemsIdentify the molecules that can be used for different functions in molecular electronics
- Choose a proper method or combined several methods for fabricating a particular componentExploit the behaviour of the biomolecules for molecular electronic
- Gain an introductory knowledge on nanophotonics

Course contents

1. Organic semiconductors and conductors for molecular electronics – concepts and choice of suitable organic molecules
2. Charge injection and transport in mesoscopic systems
3. Dynamic redox systems: Towards realisation of unimolecular memory
4. Device fabrication methods including Langmuir-Blodget Films
5. Semiconductor and molecular assembly nanowires
6. Making contacts to single molecules
7. Biology inspired concepts + Biochemical and quantum computing
8. Charge transport in DNA based devices
9. Sensing and manipulating molecules – SPM technologies for characterisation and manipulation
10. “CMOL”(hybrid semiconductor/nanowire/molecular) devices, circuits and architecture
11. Lab-on-chip concepts
12. Nanophotonics

Specific prerequisites

Bachelor's degree in physics, electrical engineering or equivalent degree

Course literature

Published articles and handouts

Examination

- TEN1 - Exam, 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.

The exam consists of a report, a seminar and home assignments. The student should write at least a5-page report on the seminar topic he/she will hold. The home assignments will be based on all the subjects that are covered in the course (both seminars and lectures). In order to gain grade Fx and above, one should solve all the home assignments besides the report and the seminar. The association of grade with the percentage of marks obtained in the home assignments is as follows: F: < 60 %; Fx: 60 – 70%; E 71– 80%; D 81 - 85%; C: 86 – 90%; B: 91- 95% ; A: 96-100%

Other requirements for final grade

Passed grades in all parts

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.