Faculty of Science

FYST31, Physics: Advanced Processing of Nanostructures, 7.5 credits

Fysik: Avancerad framställning av nanostrukturer, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2009-10-07 to be valid from 2009-10-07, spring semester 2010.

General Information

The course is an elective course for second-cycle studies for a scientific candidate - or Master's degree (120 credits) in physics.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1F, Second cycle, has second-cycle course/s as entry requirements

Learning outcomes

The course intends to give advanced knowledge in fabrication and characterisation of devices on the nanometer scale intended to be used both within nanoelectronics and within the life sciences. Focus will be on modern materials and processing technologies that are used today within nanotechnology such as electron beam lithography, scanning electron microscopy, etching etc. In the laboratory part of the course, the students will, in a project work, have access to a modern clean room where they will produce devices using the different processing technologies listed above.
Work with structures on the nanometer scale takes place in a clean and dust free environment, therefore, working methodology and security issues in clean rooms are important elements in the course.

Knowledge and understanding

On completion of the course, the student should:

- be able to explain and describe different processing technologies and how they can be implemented within the field of nanotechnology
- be able to account for how a clean room is built-up
- be able to explain the importance of working methodology in a clean room

Skills and abilities

On completion of the course, the student should:

- independently be able to carry out advanced processing in a clean room environment
- be able to design simple devices and write a detailed process flow for its production
- be able to write well-structured technical reports about semiconductor processing
- be able to present results for colleagues

Judgement and approach

On completion of the course, the student should:

- understand that it is necessary with clean rooms and a good clean room discipline to at all be able to produce devices and circuits on the nanoscale.

Course content

Lectures and laboratory work in project form.

1. The lectures start with basic clean room design, classification of clean room standards, different sources of particle contaminants and air flows and air filtering in clean rooms. Various types of clean rooms be discussed with a focus on semiconductor and nanotechnology applications. The importance of using extremely clean chemicals and gases and availability of deionized water will also be treated. Handling of chemicals and safety aspects of laboratory work will be treated in connection with the practical exercises in clean rooms. Under the second part of the lectures, the most common processing steps for producing devices will be treated such as sample preparation, wet etching, lift-off etc. This knowledge will then directly be applied in the laboratory part of the course.

2. The laboratory part will be carried out in groups of 4-5 individuals. As it is very important that work with semiconductor structures takes place in an extremely clean and dust free environment, large emphasis in the beginning of the laboratory part will be placed on working methodology in clean rooms, handling of chemicals and security issues. After this, different surface treatments, e. g. deposition of resist and

oxygen plasma., will be discussed and illustrated. The laboratory part is completed with a project, where the students will learn to use the advanced equipment required to produce and characterise nanometer scale devices. For example electron beam lithography, nanoimprint and UV lithography, scanning electron microscopy and atomic force microscopy.

Course design

The teaching consists of lectures, laboratory sessions and project work. Participation in laboratory sessions and project work and thereby integrated other teaching is compulsory.

Assessment

Examination takes place in the form of a written examination at the end of the course. Students who do not pass the regular exam are offered a new possibility shortly after the regular exam.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, approved examination, passed laboratory session and project reports and participation in all compulsory parts are required.
The final grade is determined by the written examination.

Entry requirements

For admission to the course, 90 credits natural sciences are required in which knowledge equivalent to FYSA31 Physics 3, Modern physics, 30 credits, FYSD13 Processing and device technology, 7.5 credits, should be included and English B.

Subcourses in FYST31, Physics: Advanced Processing of Nanostructures

Applies from H09

0901 Advanced Processing of Nanostructures, 7,5 hp
Grading scale: Fail, Pass, Pass with distinction