

## **FYSD13, Physics: Processing and Device Technology, 7.5 credits**

*Fysik: Process- och komponentteknologi, 7,5 högskolepoäng*  
**First Cycle / Grundnivå**

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### **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 first-cycle studies for a scientific candidate - or Master's degree (120 credits) in physics.

*Language of instruction:* English and Swedish  
If needed, the course is given in English.

*Main field of studies*

Physics

*Depth of study relative to the degree requirements*

G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements

### **Learning outcomes**

The course intends to give basic knowledge in fabrication and characterisation of semiconductor devices on the nanometer scale. Focus will be on modern materials and process technologies with a clear emphasis on nanotechnology. Most of the processes are general and are used in traditional silicon-based IC-technology as well as in advanced III-V technology and for the production of MEMS/NEMS (micro-/nano-electromechanical systems).

*Knowledge and understanding*

To pass the course, the student should:

- be able to describe manufacturing processes that are based on diffusion, deposition and patterning of surfaces
- be able to explain how such processes can be implemented on the nanometer scale
- be able to explain the connection between the possibilities and limitations of fabrication processes and device performance

### *Skills and abilities*

To pass the course, the student should:

- be able to carry out basic semiconductor processing in clean room environment
- be able to analyse a specific device and decide which processing steps that are required to produce it
- be able to write well-structured technical reports about semiconductor processing

## **Course content**

- Semiconductor materials properties
- Device fabrication: process overview, comparison between III-V and silicon
- Processes: epitaxy, doping, ion implantation, diffusion, etching, lithography
- New methods such as functionalisation of surfaces and nanoimprint lithography will also be treated
- Metal-semiconductor interfaces that are very important in a number of applications will be discussed
- Fabrication of pn-diodes and characterisation and modelling of their electronic and optoelectronic properties and applications
- Fabrication and properties of heterostructures will be treated and illustrated with heterostructure transistors
- Production and principles of MEMS/NEMS will also be treated.

During a series of laboratory sessions, some of the processing steps will be used for fabricating functioning devices. As it is very important that semiconductor processing is done in extremely clean and dust free environment, clean room working methodology will be emphasised. Finally, a number of advanced semiconductor structures and their function will be demonstrated.

## **Course design**

The teaching consists of lectures, laboratory sessions and exercises. Participation in laboratory sessions and other teaching integrated with that, is mandatory.

## **Assessment**

Written examination at the end of the course. Students who do not pass the regular exam are offered a re-exam 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.

The grades in the course are passed with distinction, passed and failed.

To pass the course, approved examination and approved laboratory reports and participation in all compulsory parts are required.

The final grade is decided by the written examination.

## Entry requirements

For admission to the course, knowledge equivalent to FYS31 Physics 3, Modern physics, 30 credits, and English B are required.

## Subcourses in FYSD13, Physics: Processing and Device Technology

Applies from H16

- 0911 Processing and Device Technology, 7,5 hp  
Grading scale: Fail, Pass, Pass with distinction
- 0912 Laboratory Exercises and Report, 0,0 hp  
Grading scale: Fail, Pass

Applies from H09

- 0901 Processing and Device Technology, 7,5 hp  
Grading scale: Fail, Pass, Pass with distinction