Course syllabus

Halvledarfysik
Semiconductor Physics

FFFN30, 7,5 credits, A (Second Cycle)

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

General Information

Main field: Nanoscience.
Compulsory for: MNAV1
Elective for: E4-is, F4, F4-nf, MFOT1, N4-nf, N4-hn
Language of instruction: The course will be given in English

Aim

The overall objective of the course is to provide in-depth knowledge of the fundamental physical principles needed to understand semiconductor devices and their function.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to give an account of essential theories and models within semiconductor physics
- be able to give an account of the operation of essential semiconductor devices based on physical principles
- be able to discuss the performance of devices in terms of material parameters and device design

Competences and skills
For a passing grade the student must

- be able to simulate and analyse devices and summarize and explain the results in a written report

- be able to solve problems and, in written form, clearly and in a structured way describe the solutions
- be able to compile a presentation based on literature for other students in the course
- be able to give examples of some relevant societal aspects of semiconductor devices and semiconductor industry

Judgement and approach
For a passing grade the student must

- be able to orally argue, use relevant concepts and draw conclusions in a scientific discussion.

Contents

The course covers basic physical theory of semiconductors:

- band structure, intrinsic and extrinsic semiconductors - charge carrier concentrations and transport phenomena
- non-equilibrium in semiconductors: excitation and recombination mechanisms, charge carrier injection
- understanding of key parameters of semiconductor materials
- properties and function of components such as pn junctions, metal-semiconductor junctions, transistors and solar cells.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The examination takes place in writing in the form of examination and a to this hearing oral test at the end of the course. Oral examination is given only for those students who passed the written examination. Examination is also in the form of written project work and laboratory sessions during the course.

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.

Parts
Code: 0123. **Name:** Laboratory Exercises.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Written reports
Code: 0223. **Name:** Written and Oral Examination.
Credits: 5. **Grading scale:** TH. **Assessment:** Written examination on campus. Oral midterm exam.
Code: 0323. **Name:** Project.
Credits: 1. **Grading scale:** UG. **Assessment:** Oral presentation of relevant literature

Admission

Assumed prior knowledge: Basic solid state physics including introduction to semiconductors and the pn-junction equivalent to Solid State Physics (FFFF05), Electronic Materials (FFFF01) or Physics of Devices (ESSF20).
The number of participants is limited to: No
The course overlaps following course/s: FFF021

Reading list

- Sze, S M and Lee, M: Semiconductor Devices - Physics and Technology. We will be using the third edition. Previous editions will be sufficient most of the

time.
- Handouts (notes and lab instructions).

Contact and other information

Course coordinator: Carina Fasth, carina.fasth@ftf.lth.se
Course coordinator: Dan Hessman, dan.hessman@ftf.lth.se
Course homepage: http://canvas.education.lu.se