IH2651 Semiconductor Theory and Device Physics, General Course 7.5 credits

Halvledarteori och komponentfysik, allmän kurs

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

Establishment

Course syllabus for IH2651 valid from Autumn 2008

Grading scale

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

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

IM2651 Physics of Electronic Materials, or similar course

Language of instruction

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

Intended learning outcomes

The main purpose of this course is to give a basic understanding of the underlying physics and how material properties affect the function of modern semiconductor devices. After the completion of the course, the students shall:Understand how the electron energies are described by a band diagram and be able to extract the salient features from such a diagram. Know the statistics describing the electron and hole concentrations at the band extrema at equilibrium. Know how dopants can be incorporated in the semiconductor and how this affects the presence of electrons and holes. Understand the transport properties of electrons and holes, and know the important scattering processes limiting the transport. Have aquired an understanding of how light (photons) are absorbed and emitted in a semiconductor. Have a clear understanding of the operation of a pn-junction and how various semiconductor materials can be utilized for electronic and opto-electronic devices.

Course contents

Brief recapitulation of crystal structure. atomic bonding and crystal type

Semiconductor theory plays a very important role in the understanding of modern electronic and optoelectronic devices. A brief recapitulation of crystal structure, reciprocal lattice and semiconductor band theory is given. Strong emphasis is put on impurities, electron and hole statistics at equilibrium and non-equilibrium situations, transport and scattering processes. Optical properties of semiconductor and absorption and emission of photons are also included. Finally, the usefulness of various semiconductor properties will also be exemplified by investigation of various electronic and opto-electronic devices.

Course literature

Semiconductor Physics and Applications, M. Balkanski and R.F. WallisUpplaga: Förlag: Oxford University Press År: 2000ISBN: 0 19 851740 8 **Undervisningsspråk:** Engelska

Examination

- INL1 - Assignments, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 4.5 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Course, 1.5 credits, grading scale: P, 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.

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

Other requirements for final grade

One written exam (TENA;4,5hp);
Project (1,5 hp)
Laboratory (LAB1; 1,5 hp)

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.