SK2822 Compound Semiconductors and Photonic Devices 7.5 credits

Sammansatta halvledare och fotoniska komponenter

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 SK2822 valid from Autumn 2018

Grading scale

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

Education cycle

Second cycle

Main field of study

Physics

Specific prerequisites

Basic courses in solid state physics, materials science, semiconductor physics.

Language of instruction

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

Intended learning outcomes

After the course, the student should be able to:

- Describe relevant material, optical and transport properties of compound semiconductors and their facility to form heterostructures in a flexible manner for fabricating photonic devices
- Describe epitaxial methods to realize discrete and integrated photonic devices and the characteristics of the photonic devices along with their applications
- Describe trends in heterogeneous integration of compound semiconductors on lattice mismatched substrates or non-polar substrates
- Design a particular photonic device from judicious choice of compound semiconductor heterostructures.

Course contents

The aim of the course is to treat the compound semiconductors from materials point of view amenable for photonic devices. The main contents are:

- Thermodynamics relevant to compound semiconductor crystal growth
- Bulk crystal growth and epitaxial techniques
- Defects in semiconductors
- Semi-insulating compound semiconductors by doping
- Modification of bandstructure by alloying, heterostructures and strain
- Simulation of heterostructures and effect of strain in semiconductor bandstructures
- Quantum Wells, Quantum Wires, Quantum Dots
- Optical and transport properties and methods of characterizing them
- Discrete photonic devices such as LEDs, lasers, solar cells, detectors, modulators and waveguides .
- Integrated photonic devices
- Hybrid and monolithic integration of compound semiconductors on silicon and germanium - present trends
- Introduction to electronic components based on compound semiconductors
- Compound semiconductor processing

Course literature

Jasprit Singh, Semiconductor Devices, John Wiley & Sons , NY, 2001(ISBN 0-471-36245-X)

Pallab Bhattacharya, Semiconductor optoelectronic devices, 2nd ed., Prentice-Hall, NJ, 1997 (ISBN 0-13-495656-1)

Relevant scientific articles and lecture notes

Examination

- LAB1 - Labs, 1.5 credits, grading scale: P, F
- TEN1 - Written Examination, 6.0 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.

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.