IF1602 Physics part 2, Material Physics 6.0 credits

Fysik del 2, materialfysik

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 IF1602 valid from Autumn 2008

Grading scale

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

Education cycle

First cycle

Main field of study

Physics,Technology

Language of instruction

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

Intended learning outcomes

The main goal of the course is to give an introduction to the microscopic physics that govern the behaviour of electrons, atoms, nuclei and how this relates to macroscopic properties of solid materials.

After the course the student should be able to:

- judge when a classic description is sufficient to solve a problem and when a quantum mechanical description is necessary.

- describe the construction of the atom and the periodic table and what the quantum numbers represent.

- describe and give example of chemical bonds and what effect it has on the electrical, optical and mechanical properties of a solid material.

- describe how and why a nuclear power plant functions

- describe the atomic lattices, their dynamic properties and how structure and lattice parameter are determined by X-ray diffraction

- describe the free electron model, and from this one estimate the thermal and electrical properties of metals.

- describe the influence of a periodic potential on the electrons in a solid material

- determine electrical and optical properties from a band diagram

- describe and calculate electrical properties of some electronic components.

Course contents

The course gives an introduction to quantum physics and quantum mechanics applied to atoms and solid materials, with focus on issues within materials physics that an engineer may encounter.

The course describes:

quantum physics and the particle-wave duality principle, the Schröding equation and its solution for a few selected potentials.

The construction of the atom and the periodic table. The quantum numbers of the electron and the electron spin.

Molecules and chemical bond. Rotations and vibrations.

Nuclear physics, models for the atomic nucleus, decay, nuclear reactions, fission, fusion and nuclear power.

Materials physics: crystal lattice, X-ray diffrcation, lattice vibrations, the free electron model and the electric and thermal properties of metals. Energy bands, optical and electrical properties of semiconductors, electronic devices.

Specific prerequisites

Physics 1 (IF1601)
Mathematics (5B1103)

Course literature

Physics for scientists and engineers with modern physics, R.A.Serway, R.J.Beichner, 6th Ed, Harcourt College Publishers, ISBN: 0534408559

Solid State Physics, J.R. Hook & H.E. Hall, 2nd Ed, John Wiley & Sons, ISBN: 0-471-92805-4

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 4.5 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.

Other requirements for final grade

Laborations, 1.5 hp (LAB1)
Written exam, 4.5 hp (TEN1)
Grading: A/B/C/D/E/Fx/F

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.