SH1009 Modern Physics 10.5 credits

Modern fysik

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 SH1009 valid from Autumn 2008

Grading scale

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

Education cycle

First cycle

Main field of study

Physics,Technology

Specific prerequisites

Courses in physics (or equivalent): SI1100, SK1100 and SI1140, in mathematics (or equivalent): SF1604, SF1602 and SF1603, in mechanics (or equivalent): SG1130.

Language of instruction

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

Intended learning outcomes

After completing this course a student should be able to:

- Explain the scientific basis of modern physics, as defined by the course syllabus.
- Set up and perform quantum mechanical calculations on simple systems
- Apply quantum mechanical principles to scientific and technical applications
- Report on practical experience concerning experimental methods within modern physics

Course contents

Part I (The experimental background of Modern Physics nd quantum mechanics). 7.5 hp.

The experimental foundations of modern physics: Elementary relativity theory. The Michelson-Morely experiment. Einstein's theory of special relativity. Length contraction. Time dialation. Elementary quantum physics. Planck's radiation law. X-ray radiation and spectra. Rutherford's atomic model. Atomic structure. Bohr's atomic model. Atomic energy levels. Nuclear structure. Radioactive decay. Matter waves. Wave packets and the Heisenberg Uncertainty Principle. Wave-particle duality.

Quantum mechanics: the foundations of quantum mechanics. Operators and commutation relations. The Schrödinger equation applied to simple potentials. Interpretation of wave functions. Plane wave solutions. The harmonic oscillator. Angular momentum and spin. The hydrogen atom and the periodic table. The Pauli principle. Lowest order time independent perturbation theory and applications there-of. Applications to physical phenomena: (including) the photoelectric effect, the Compton effect, X-ray diffraction, particle diffraction, the Stark effect, the Zeeman effect. Applications within science and technology (including) tunneling, the tunneling electron microscope, the Stern-Gerlach experiment, the atomic nucleus, the helium atom, simple molecules.

Part II (Laboratory exercises and project work). 3 hp.

Three laboratories with written reports (1.5 hp). Project work (1.5 hp).

Course literature

Modern Physics, Randy Harris. Pearson / Addison-Wesley.

Examination

- LAB1 - Laboratory Work, 1.5 credits, grading scale: P, F
- PRO1 - Project, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 7.5 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

Three home assignments (optional) and a written examination (TEN1, 7.5 hp). Laboratory exercises (LAB1, 1.5 hp). Project work (PRO1, 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.