SH1012 Modern Physics 8.0 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 SH1012 valid from Spring 2012

Grading scale

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

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Courses in physics (or equivalent): SI1121, SK1102, SI1140; courses in mathematics (or equivalent): SF1604, SF1602, SF1603, SF1901; courses 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 relativistic calculations for simple cases and 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
- Complete a simple research project with a modern physics focus as part of a small group

Course contents

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. Introduction to operators. 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.

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. The building blocks of matter: particles and their interactions.

Course literature

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

Examination

- LAB1 - Laboratories, 1.0 credits, grading scale: P, F
- PRO1 - Project, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 5.5 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.

Written examination (5.5 hp)

Laboratory exercises with written reports (1 hp)

Project work (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.