



Faculty of Health, Science and Technology
Physics

Syllabus

Introductory Modern Physics

Course Code: FYGA21

Course Title: Introductory Modern Physics
Inledande modern fysik

Credits: 7.5

Degree Level: Undergraduate level

Progressive Specialisation: First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:

FYA (Physics)

TKA (Engineering Physics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2025-02-25, and is valid from the Autumn semester 2025 at Karlstad University.

Prerequisites

Completed Experimentation and data analysis, 7.5 ECTS credits, Foundation course in mathematics, 7.5 ECTS credits, and Calculus and geometry, 7.5 ECTS credits, and registered for Wave physics and optics, 7.5 ECTS credits, Mechanics with applications 1, 7.5 ECTS credits, Linear algebra, 7.5 ECTS credits, and Calculus in several variables, 7.5 ECTS credits, or equivalent

Learning Outcomes

Upon completion of the course, students should be able to:

- describe, use, and explain various models of the atom, their development and relevant experimental methods,
- describe the structure of atoms by using quantum-physical concepts, such as quantisation, probability density, energy states, and quantum numbers, and use the quantum model to

obtain relevant physical quantities,

- apply their knowledge of the behaviour of particles and waves in order to describe the wave-particle duality and estimate its consequences for physical phenomena,
- analyse basic quantum mechanical model systems and perform calculations on these,
- analyse the effect of relativistic velocity on physical phenomena,
- describe and apply models for elementary particles,
- apply the concepts stated above to basic physical problems, formulate the problems mathematically, and calculate and critically assess the magnitude of the results, and
- give an account of the origins of the quantum theory and situate the discoveries of modern physics in the history of science.

Content

Quantum physics and its applications: From classical physics to quantum physics, wave-particle duality, quantum mechanics, states and quantum numbers of atoms, nuclear structure, nuclear reactions, radioactivity, and elementary particles. Simple model systems, such as particle in a box and harmonic oscillators. Atoms with several electrons, chemical bonding between atoms. Special theory of relativity, relativistic momentum, relativistic energy. Elementary particle physics and Feynman diagrams.

Laboratory experiments on the energy levels of simple atoms, and beta-particles.

Reading List

See separate document.

Examination

Assessment is based on a written exam, individual hand-in assignments, and laboratory reports completed in groups. Laboratory sessions are mandatory.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.