



Board of Teacher Education
Physics

Syllabus

Physics I and Physics Education

Course Code:	FYGL12
Course Title:	Physics I and Physics Education <i>Fysik I med didaktisk inriktning</i>
Credits:	30
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)

Course Approval

The syllabus was approved by the Board of Teacher Education 2017-08-30, and is valid from the Autumn semester 2018 at Karlstad University.

Prerequisites

Field-specific eligibility A6c (Physics 2 and Mathematics 4) plus Mathematics 15 ECTS credits

Learning Outcomes

The aim of the course is that students acquire knowledge in physics and physics education with an emphasis on the interplay between experiment and theory and how this affects teaching and learning in physics. The course comprises four modules and theoretical as well as laboratory components.

Module 1. Measuring and Modelling, 7.5 ECTS cr

Upon completion of the model, students should be able to

1. design and assess the validity of a mathematical model for a mechanical system,
2. give an account of basic mechanical concepts and laws and demonstrate ability to apply them regarding equilibrium problems and motion sequences,
3. develop and carry out laboratory investigations and experiments adapted to educational needs,
4. independently seek information of the development of physics and physics education,
5. give an account of the history and development of ideas in physics and link to how learners' conceptual understanding is developed in the physical sub field of mechanics, and
6. analyse curricula and instructions for assessing and grading.

Module 2. Energy and Sustainable Development, 7.5 ECTS cr

Upon completion of the model, students should be able to

1. give an account of energy concepts, energy forms and work and electromagnetic radiation,
2. give an account of the earth's radiation balance in the solar energy flow,
3. give an account of the relationship between energy for sustainable development and aspects of energy extraction in relation to basic physical principles,

4. give an account of different basic physical concepts such as pressure, heat, magnetism and induction which are prerequisites for societal energy production and its consequences,
5. reflect on research results on meaningful learning in the physics classroom,
6. independently plan and conduct investigations and laboratory experiments to seek answers to their own formulated questions in the field, and
7. give an account of the development of the history of ideas in physics and relate to learners' conceptions of energy.

Module 3 The Universe, 7.5 ECTS cr

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

1. give an account of the formation and structure of the solar system, the emergence, the evolution and final stage of stars, and
2. give an account of black hole theories, the structure of galaxies and the large-scale structure and development of the universe.

Module 4. Electric Circuits, 7.5 ECTS cr

Upon completion of the module, students should be able to

1. demonstrate knowledge of basic concepts and components of electricity,
2. demonstrate basic knowledge of electrical measuring methods and the use of electrical instruments,
3. calculate simple circuits with the help of Ohm's law, Kirchhoff's laws, nodal and loop analysis, superposition theorem and the two pole theorem,
4. calculate simple alternating currents with diagram and the jw-method,
5. perform simple connections with passive components and operational amplifiers,
6. measure current, voltage, resistance, amplitude, period and frequency, and
7. present laboratory results in a written report.

Content

Module 1 Measuring and Modelling, 7.5 ECTS cr

Students are introduced to basic physical concepts through laboratory sessions and group study. They plan and conduct physical experiments, including analysing sources of error and applying accuracy to data measurements and drawing relevant physical conclusions. They also practise compiling written reports with the help of computer-based presentation software. The physical concepts and phenomena studied in the course are energy and motion, velocity and acceleration, and Newton's laws.

The teaching methodological perspective deals with how laboratory components can be used to develop understanding of physics in school, and students also analyse summative and formative evaluation in relation to the assessment and grading in physics in education.

Module 2 Energy and Sustainable Development, 7.5 ECTS cr

The basic concepts in the area of energy, especially earth's radiation balance in the solar energy flow. Active use of ICT is an element of several course components. The particle model is studied to describe and explain the properties of gases and phase transitions, pressure, volume and density and how particle movement can explain the spread of matter in nature. Field descriptions of electric and magnetic forces and relation between magnetism and electricity including induction. Applications such as solar cells, solar thermal collectors, heat pumps, heat exchanger, bio fuel and water and wind energy are used in the students' own laboratory experiments. Energy for sustainable development and aspects of energy gain are discussed, and the relation between human, energy and the environment are problematised. Research results relating to meaningful learning in the physics classroom are applied in instruction and in the planning of teaching in school. Students plan and carry out investigations independently to find answers to their problem formulations. Diversity and gender aspects of physics as a subject discourse are problematised.

Module 3 The Universe, 7.5 ECTS cr

The course includes lectures, films, interactive computer use of astronomy software and observations of stars

through the telescope. The module deals with the formation and structure of the solar system with a focus on the circumstances of our solar system. The formation, evolution and final stage of stars are also treated along with the black holes assumed to exist, the structure of galaxies and the large-scale structure and evolution of the universe as well as speculations on the creation and future destiny of the universe.

Module 4. Electric Circuits, 7.5 ECTS cr

Instruction is in the form of lectures, supervised exercises and mandatory laboratory sessions. Areas treated are basic concepts such as charge, current, potential, voltage, conductor, isolator, resistance, conductance, effect and energy and electric and magnetic fields. Students are introduced to components such as passive components (resistor, capacitor, coil), diode, operation amplifiers and their use and ideal transformers. In electric circuit theory students calculate with Ohm's law, Kirchhoff's laws, superposition theorem, two pole theorem and nodal and loop analysis, and also in the area of effect and effect adjustment and two pole equivalence. Definitions and connections such as sinusoidal current and voltage are treated and in these contexts calculations with diagrams and the jw-method, resonance circuits and loading and unloading the capacitor. Operation amplifier is treated. Laboratory tasks are included such as connecting simple circuits on breadboard, measuring current, voltage and resistance and amplitude and frequency. Students present the results in a written report.

Reading List

See separate document.

Examination

Assessment is based on:

Module 1

Learning outcomes 1 and 2: written exam or individual hand-in assignments (to be announced at the start of course).

Learning outcome 3: oral group presentation and a hand-in assignment.

Learning outcomes 4, 5 and 6: seminar participation.

Module 2

Learning outcomes 1 and 4: written exam

Learning outcome 6: laboratory work

Learning outcomes 2, 3, 5 and 7: seminar participation

Module 3

All learning outcomes: written exam.

Module 4

Learning outcomes 1, 2, 3 and 4: written exam.

Learning outcomes 5, 6 and 7: laboratory work.

Individual performance must be clearly displayed for assessment.

Grades

One of the grades Distinction (VG), Pass (G) or Fail (U) 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.

Teacher Education: Secondary levels