



Joint Faculties of Humanities and Theology

ÄFYA02, Physics: Mechanics, 7.5 credits

Fysik: Mekanik, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2025-12-10. The syllabus comes into effect 2025-12-10 and is valid from the autumn semester 2026.

General information

The course is part of the subject teacher education programme at Lund University.

Language of instruction: Swedish

Certain elements may be carried out in English in connection with laboratory work.

Main field of study *Specialisation*

Physics G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Learning outcomes

The course aims to provide an introduction to areas of university physics relevant for subject teachers in physics, serving as a foundation for further studies in the field. Particular emphasis is placed on basic mechanics, as a fundamental basis for the rest of physics.

Knowledge and understanding

On completion of the course, the student shall be able to:

1. describe and apply mechanics to solve conceptual problems
2. give an overview of the methods, ideas, and assumptions of physics as a basis for studies in physics in general and mechanics in particular
3. provide an overview of, apply, and discuss methods within mechanics based on Newton's laws
4. describe dynamical systems in linear motion and rotation

5. describe harmonic oscillations, including damped and forced oscillations as well as resonance
6. describe special relativity, including Lorentz transformations
7. describe elementary problems in three-dimensional mechanics using vectors, the scalar product, and the vector product
8. give examples of current research topics in mechanics and relate them to their own learning
9. account for mechanics with respect to its applications in the surrounding world.

Competence and skills

On completion of the course, the student shall be able to:

10. use measurement instruments that are relevant for the course
11. based on given instructions, carry out a simple critical analysis of experimental data
12. carry out measurements and with supervision carry out laboratory sessions in mechanics
13. use the basic concepts, carry out calculations and solve theoretical problems in mechanics
14. in groups suggest procedure and methods to solve a given problem
15. write a laboratory report that follows a given principal layout, and therein account for the aim of the laboratory work, the methods, the materials used, and to illustrate the results in the form of tables and figures
16. give simple and basic constructive feedback on a laboratory report.

Judgement and approach

On completion of the course, the student shall be able to:

17. based on the concepts of mechanics, discuss phenomena and examples in the surrounding society
18. give examples of ethical aspects, motives for or against and consequences of the application of mechanics in different situations
19. reflect on their progress in terms of knowledge and competence based on the course goals and their own goals.

Course content

The course covers kinematics and dynamics, mainly based on Newtonian mechanics, using vector formalism, differentiation and integration, and applying these to both linear and rotational motion. Important concepts include conservation principles, with the introduction and use of the concepts of energy, momentum, and angular momentum. The course also includes statics and an introduction to special relativity.

Important subject-specific concepts are:

Kinematics

Linear motion in one, two and three dimensions. Fundamental quantities: position, velocity and acceleration, both instantaneous and average. Freely falling bodies. Applications of differentiation and integration. Interpretation of diagrams of position, velocity and acceleration as a function of time. Three-dimensional motion, using vector formalism as well as polar and spherical coordinates. Circular motion with angular velocity and acceleration.

Dynamics

Dynamics is described in the course using Newtonian mechanics. Newton's three laws, their applications and conceptual interpretation. Free body diagrams. Particle dynamics, friction, circular dynamics. Work, kinetic and potential energy. Conservation of energy. Gravitation with applications, for example escape velocity and Kepler's laws. Elastic forces and energy diagrams. Linear momentum and preconditions for its conservation. Impulse. Introduction to inelastic and elastic collisions.

Rotational dynamics

Rotation of particles and rigid objects. Angular momentum and preconditions for its conservation. The analogy between linear and rotational dynamics. Rotational energy. The parallel axis theorem. Torque and angular acceleration.

Statics

Conditions for equilibrium. Centre of gravity and its relation to the centre of mass.

Special relativity

The postulates of relativity, relativity of simultaneity, time dilation, length contraction, Lorentz transformations, relativistic momentum and energy, and the Doppler effect for electromagnetic waves. Simple spacetime diagrams.

Course design

The teaching consists of lectures, group work, problem-solving exercises, and laboratory sessions. Participation in laboratory sessions and introductory meetings, as well as in components that treat laboratory safety is compulsory.

Assessment

Examination takes place in the form of a written examination, written reports, and through compulsory components:

- written examination in electricity and magnetism at the end of the course, which assesses the intended learning outcomes 1-9, 13, 17-19, and corresponds to 6 credits
- completed laboratory sessions and written laboratory reports, as well as peer review of another student's report; this assesses the intended learning outcomes 2 and 10-16, which corresponds to 1,5 credits.

Students who do not pass the regular examination will be offered another opportunity for examination soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass, Pass with distinction

The laboratory sessions are graded according to the scale of Fail and Pass, while the examination is graded according to the scale of Fail, Pass, and Pass with distinction.

To pass the whole course, the student must have a passing grade on the written exam, pass all laboratory sessions and laboratory reports, and participate in all compulsory activities:

- introductory meeting
- introductory sessions for laboratory work
- laboratory sessions.

Calculation of grade

- Reports and other compulsory components only grade Fail or Pass. These components are not included in the calculation of the final grade.
- Examination results are given as a percentage that corresponds to the score achieved in the written examination, relative to the maximum possible score. The threshold for a Pass is normally 50 %, and 80 % for a Pass with Distinction.
- The final grade for the course is determined by the grade of the written examination.

Entry requirements

General entry requirements and studies equivalent of courses Physics 2, Mathematics 4 and English 6 from Swedish upper secondary school, as well as 15 credits in university-level mathematics.

Further information

The course cannot be included in a degree together with FYSA22 Physics: Introduction to University Physics, with Mechanics (7.5 credits), ÅFYD11 Physics 1: Introductory Physics and Physics Education (30 credits), or equivalent earlier courses.