



LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Fysik - Våglära, termodynamik och atomfysik

Physics - Waves, Thermodynamics and Atomic Physics

FAFA05, 12 credits, G1 (First Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED N

Date of Decision: 2023-04-17

General Information

Main field: Technology.

Compulsory for: N1

Language of instruction: The course will be given in Swedish

Aim

The aim of this course is for the student to acquire a fundamental knowledge of waves, optics, thermodynamics, atomic physics and applications within the areas. A good understanding of these parts of physics is essential for concept-building within rapidly developing research areas such as e.g. nanotechnology.

The course will also train the students ability of problem solving, modelling, experimental work and written communication. The course is also aiming at stimulating the student to apply physics in explaining everyday phenomena.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to analyze problems and perform and interpret calculations within the area of knowledge.
- understand how mathematical models, analogies and pictures interact with experiments and reality.
- be able to explain everyday phenomena using correct concepts and a physics language.

Competences and skills

For a passing grade the student must

- be able to use and interpret models.
- be able to use the knowledge of basic physics to understand the areas or research presented in parallel courses.
- be able to apply the experimental methods presented in the course.
- be able to write a well structured project report in which experimental data are presented and analyzed.
- be able to perform oral presentations and participate in discussions.
- be able to search for and use relevant information within the area of knowledge.

Judgement and approach

For a passing grade the student must

- be able to evaluate experimental methods used in the course.
- be able to evaluate results of different experimental methods.

Contents

It is important that the student understands how different parts of the course relate to each other and to rapidly developing research areas like e.g. nanotechnology. The laboratory work is essential for visualizing important concepts of physics.

The first part of the course deals with: Temperature and heat. Phase transitions. Equations of state for ideal and real gases. Friction and viscosity. Heat engines and refrigerators. Entropy and the laws of thermodynamics. Mechanical waves, interference and the Doppler effect. Sound intensity level and human hearing. Reflection of sound, ultrasound. Electromagnetic waves. Geometric optics and optical instruments. Diffraction and resolution. The grating spectrometer.

The latter part of the course deals with: Relativistic mechanics. Charge and wave properties of the electron. Atomic size and mass. Thermal radiation. Photoelectric effect. Models of the atom - from Bohr to a wave model. The world according to quantum mechanics. Matterwaves. Structure of the periodic system. Spontaneous and stimulated emission. Lasers, X-rays and radioactivity.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: Compulsory exercises/assignments, written examination and passed laboratory work. The result on the written examination settles the final grade. It is mandatory to attend the first lecture in order to be admitted to the course.

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.

Parts

Code: 0115. **Name:** Physics - Waves, Optics and Atomic Physics.

Credits: 6,5. **Grading scale:** TH. **Assessment:** Written examination. **Contents:** Mechanical waves, interference and the Doppler effect. Sound intensity level and human hearing. Reflection of sound, ultrasound. Electromagnetic waves. Geometric optics and optical instruments. Diffraction and resolution. The grating

spectrometer. Relativistic mechanics. Charge and wave properties of the electron. Atomic size and mass. Thermal radiation. Photoelectric effect. Models of the atom - from Bohr to a wave model. The world according to quantum mechanics. Matterwaves. Structure of the periodic system. Spontaneous and stimulated emission. Lasers, X-rays and radioactivity.

Code: 0215. **Name:** Laboratory Projects and Reports.

Credits: 3. **Grading scale:** UG. **Assessment:** Active participation in laboratory work. Passed written and oral project presentations. **Contents:** Laboratory work: Experimental methodology. Heat engines. Diffraction of lightwaves. Geometrical optics. Photoelectric effect. Ionizing radiation.

Code: 0315. **Name:** Thermodynamics - Assignments.

Credits: 2,5. **Grading scale:** UG. **Assessment:** Passed compulsory assignments in Thermodynamics. **Contents:** Compulsory assignments in Thermodynamics.

Admission

The number of participants is limited to: No

The course overlaps following course/s: FAFA50, FAFA60, FAFA70, FAFA75, FAFF40, FAFA65, FAFF36, FAF220, FAF260, FAFA01, FAFA15, FAFA20, FAFA30, FAFA35, FAFA55, FAFF25, FAFF30, FAFF35, FAFA45

Reading list

- Jönsson, G: Våglära och optik. Teach Support 2018. ISBN: 978-91-639-4349-2.
- Jönsson, G: Tillämpad atomfysik. Teach Support 2020. ISBN: 978-91-519-0554-9.
- Jönsson, G: Fysik i vätskor och gaser. Teach Support 2021. ISBN: 978-91-637-9826-9.
- Laborationshandledning för Nano.

Contact and other information

Course coordinator: Claes-Göran Wahlström, Claes-Goran.Wahlstrom@fysik.lth.se

Course coordinator: Jonas Johansson, jonas.johansson@ftf.lth.se

Course homepage: <http://the course is found in Canvas>

Further information: It is mandatory to attend the first lecture in order to be admitted to the course. Some elements may be taught and assessed in English. This includes a maximum of 2.5 hp, in the form of laboratory sessions or written assignments.