

Course syllabus

Fysik - Termodynamik och atomfysik Physics - Thermodynamics and Atomic Physics

FAFA35, 6 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: E2

Language of instruction: The course will be given in Swedish

Aim

The student should develop his understanding of basic concepts and ideas within both classical and modern physics needed in subsequent courses and necessary for a future role as an electrical engineer. Many of the concepts introduced are also of great importance for a deeper understanding of the world around us and as parts of the general scientific knowledge. The course should also train the student in scientific problem-solving techniques and in written presentations of experimental data and comparisons with physics models. Together with other courses in the program the student should expand and maintain his ability to use high-level programs (e.g. MatLab) as a tool for presenting and analyzing experimental data and physics models.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- understand the relation between experiments, models and theory
- be able to analyze thermodynamic processes and estimate their efficiencies.
- be able to calculate the heat transport in media using different processes

- be able to describe the properties and dynamics of microscopic systems such as atoms, and molecules using elementary quantum mechanics.
- understand simple models of how the greenhouse effect works and how these models depend on both thermodynamics and molecular physics.

Competences and skills

For a passing grade the student must

- be able to formulate and solve problems in physics using mathematical methods.
- appreciate the scientific method of applying the same models, with different degree of approximation, to a number of different problems.
- be able to plan and perform physics experiments.
- be able to write a laboratory report that presents and analyzes experimental data in relation to physical models.
- be able to use high-level software (e.g. MatLab) to visualize, present and analyze data and theoretical models
- be able to calculate on simple models of the greenhouse effect

Judgement and approach

For a passing grade the student must

- be able to evaluate models and technical applications in a scientific manner
- increase his ability to work in a group towards a common goal

Contents

Heat and phase transitions. Equations of state for ideal and real gases. Kinetic gas theory and Maxwell-Boltzmann distribution. The laws of thermodynamics. Heat engines and refrigerators. Heat transfer. Wave-particle duality. The Bohr atomic model. Schrödinger equation. Quantized angular momentum. Wave functions. X-rays. The Pauli principle and the periodic system. Molecular spectroscopy. Structure of solids. Semiconductors.

Examination details

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

Assessment: Written exam and completed laboratory sessions.

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: 0108. **Name:** Physics - Thermodynamics and Atomic Physics.

Credits: 4. **Grading scale:** TH. **Assessment:** Written exam. **Contents:** Physics - Thermodynamics and atomic physics

Code: 0208. **Name:** Laboratory Sessions in Thermodynamics and Atomic Physics.

Credits: 2. **Grading scale:** UG. **Assessment:** Completed laboratory sessions and reports. **Contents:** The laboratory sessions: Heat engines, Spectroscopy and Photoelectric effect

Admission

Assumed prior knowledge: FAFA01 Physics - Mechanics and Waves, FMAA05 Calculus in One Variable. Experience of MatLab.

The number of participants is limited to: No

The course overlaps following course/s: FAFA65, FAFF25, FAFA70, FAFA75, FAF024, FAFA05, FAFA15, FAFA20, FAFA45

Reading list

- Tipler, P A, Mosca, G. Physics for Scientists and Engineers. Extended version, sixth edition. Freeman 2008, ISBN: 0-7167-8964-7.
- Laboratory work manual Fysik - Termodynamik och atomfysik för E.

Contact and other information

Course coordinator: Johan Mauritsson, Johan.Mauritsson@fysik.lth.se

Further information: The written exam will be digital. Some elements may be taught and assessed in English. This includes a maximum of 1 hp, in the form of laboratory sessions or written assignments.