IF1614 Thermodynamics and Statistical Physics 7.5 credits

Termodynamik och statistisk fysik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for IF1614 valid from Spring 2015

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The course gives the basic knowledge and skills within thermodynamics and statistical physics that an electrical engineer would need and that are required to enter a Master's programme within a physics related subject area. The students should be able to utilise their knowledge to solve basic, practically orientated, problems in the area.

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

- account for the concept of energy and how energy is stored and it is transferred between different forms during thermodynamic processes.
- apply idealised thermodynamic processes (isochoric, isobaric, isothermal and adiabatic) both independently and as part of a thermodynamic cyclic process.
- master thermodynamics the first and second laws and be able to utilise these in calculations of energy and entropy.
- relate energy flow in thermodynamic circuit processes to the efficiency at engines and to the figure of merits of heat pumps and cooling engines and carry out calculations.
- carry out calculations on heat transport problems (radiation, convection, heat conduction).
- describe the connection between macroscopic thermodynamic units and statistical physics description of equivalent phenomenon.
- apply statistical distributions within different relevant fields for an electrical engineer (for example metals/conductors, semiconductors, radiation).
- be acquainted with basic concepts within statistical physics.
- describe the thermodynamic aspects of sustainable development.
- be familiar with simulations of physical problems.

Course contents

- Energy and heat
- Gas laws
- Thermodynamics 1st and 2nd main clause, entropy
- Thermodynamic processes, the Carnot process, efficiency and figure of merits
- Heat transport (radiation, convection, heat conduction)
- Bose-Einstein, Fermi-Dirac and Maxwell-Boltzmann's distributions and different practical applications to these distributions (metals, semiconductor, radiation)
- Partition function, state density
- Free energy, enthalpy, Maxwell relations
- Planet Earth as a thermodynamic system

Specific prerequisites

- Basic physics (equivalent IF1603)
- Mathematical analysis in several variables (equivalent SF1626)
- Statistics (equivalent SF1901)

Course literature

O. Beckman et al, Energilära – grundläggande termodynamik, Liber

S.J. Blundell et al, Concepts in thermal physics, Oxford University Press

Additional material from the department.

Examination

- PRO1 - Project, 1.5 credits, grading scale: P, F
- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.