SI1162 Statistical Physics 7.5 credits

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 SI1162 valid from Spring 2019

Grading scale

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

Education cycle

First cycle

Main field of study

Physics,Technology

Language of instruction

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

Intended learning outcomes

Upon completion of the course you will

- know the definition of, and be able to use, the most important concepts in thermodynamics and classical, as well as quantum mechanical, statistical physics.
- know, be able to analyze and apply theories and models of thermodynamic processes and statistical distributions, with particular emphasis on the validity of approximations used.
- be familiar with the relation between the phenomenological thermodynamics and the microscopic description in statistical physics.
- be able to independently treat problems in thermodynamics and statistical physics.
- know, and be able to develop, applications in physics and other natural sciences based on thermodynamic and statistical physical principles.
- have a certain knowledge of technical applications of thermodynamics and statistical physics.

Course contents

Thermodynamics is a phenomenological macroscopic theory of energy conversions. Heat, which is an energy form with special properties, is particularly considered. The fundamental laws of thermodynamics, relating to energy and entropy, describe the conditions for various processes. The applicability of thermodynamics is due to the general character of its concepts. This part of the course constitutes a more deeply penetrating continuation of the course on thermodynamics for CTFYS1.

Statistical physics provides the microscopic molecular background of thermodynamics. By a statistical description based on the microscopic states of a system, averages of microscopic entities can be determined and constitute thermodynamic macroscopic entities. Modern statistical physics is formulated in terms of so called ensemble theory. Ideal gases and non-interacting spin-systems are among systems treated.

Quantum statistics demonstrates how the symmetry properties of quantum-mechanical wavefunctions influence the thermodynamic and statistical properties of a system. One distinguishes Bose- Einstein statistics for systems described by symmetric wavefunctions and Fermi-Dirac statistics for systems described by antisymmetric wavefunctions. Quantum statistics is applicable to electrons in metals and semiconductors, electromagnetic radiation, lattice vibrations, a.o.

Specific prerequisites

Recommended prerequisites: Differential and integral calculus (in particular partial derivatives and functions of several variables), Mathematical statistics, Quantum mechanics and Thermodynamics (for CTFYS1).

Course literature

S.J. Blundell and K.M. Blundell: Concepts in thermal physics (Second Edition, Oxford University Press, 2010). Chapter 1-8,11-30 and 35-37 included in the course.

Examination

- TEN1 - Examination, 7.5 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.

Other requirements for final grade

Written exam, grade A-E, (TEN1; 6 university credits: problemsolving similar to that trained in the course).

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.