

THERMODYNAMICS AND STATISTICAL MECHANICS

Bachelor education with physics.

7.5 ECTS

Autumn, Tuesday afternoon at 13-16 / Friday morning at 9-12. 24 class sessions.
Next time: Autumn 2011.

The course is one out of three courses that can be chosen as *special course* for the bachelor program in physics. The two other possibilities are “Modelling of Physical Systems” and “Problem Solving in Physics I”. The two courses not taken as the special course have to be taken as the two bachelor courses.

Teacher: Bo Jakobsen.

Course homepage: <http://dirac.ruc.dk/~boj/Termo>

Language: The course will be in English if required, otherwise in Danish.

Course objectives: The aim of the course is that the student can demonstrate:

- a profound understanding of the two fields of physics : “thermodynamics” and “statistical mechanics”, as well as the relationship between them.
- ability to solve relevant problems within these two fields of physics.

Contents:

- The concepts of temperature and entropy.
- The three laws of thermodynamics
- Equations of state.
- Free energies and their derivatives.
- Phases of matter and phase transformations.
- Boltzmann's statistics. Partition function and its derivatives.
- Systems of interacting particles.

Frequently used math: Taylor expansion, differentiation of functions of multiple variables, substitution of variable.

Prerequisites: The courses: ”Calculus of several variables” and ”Classical mechanics supplemented with elementary atomic physics”.

Course format: Preparations consists of studying assigned sections and exercises in the textbook. The theory is presented by lectures and presentations by the students. Exercises are presented by students. It will be possible to hand in written solutions to a number of exercises (including old exams) for commenting.

Evaluation: The course is evaluated by a written 4 hour final exam. Students' answers will be evaluated by the teacher and an “external examiner” (censor). Aids (hjælpemidler): A simple calculator (no “symbolic algebra” (CAS) or graph abilities allowed). One or more pages with the most important formulas from the curriculum (known as the “golden sheet”) will be handed out at the exam. The will be given one final grade on the Danish standard scale “7-trins-skalaen”.

Criteria for the evaluation: The written answers to the exam is marked and a grade will be given based on the extent and depth of the answers. The score to each question in the exam will not only be based on whether the result given is correct, but also on the student's analysis of the problem and indication of the route to a solution, even if it has not been possible for the student to complete the analysis.

The course objectives are completely fulfilled if the exam is answered with a few minor errors, with clear and solid presentation of the analysis and if the applied theories and methods are correctly identified and applied.

The course objectives are intermediately fulfilled, if the greater part of the answers to the exam is correct with a reasonable clear presentation of the analysis, and if there are only minor errors in the application of the theories and methods.

The course objectives are only just fulfilled, if a sufficient portion of the answer to the exam is correctly given, including a, possible somewhat unclear, presentation of the analysis. The application of theories and methods are to a limited extend correct.

Teaching materials:

"Thermal physics", Daniel V. Schroeder, Addison Wesley Longman, 2000. (Available from the university book store)