Department of Physics

Stockholm University

Syllabus

for course at first level

Statistical Mechanics and Condensed Matter
Statistisk mekanik och kondenserad materia

7.5 Higher Education Credits
7.5 ECTS credits

Course code:	FK5025
Valid from:	Autumn 2016
Date of approval:	2016-02-29
Department	Department of Physics
Main field:	Physics
Specialisation:	G2F - First cycle, has at least 60 credits in first-cycle course/s as entry requirements

Decision

Prerequisites and special admittance requirements

For access to the course knowledge and skills equivalent to the following courses is required:
• Mathematics for Natural Sciences I, 15 hp (MM2002)
• Mathematics for Natural Sciences II, 15 hp (MM4001)
• Mathematics II - Analysis, part A, 7.5 hp (MM5010)
• Mathematics II - Analysis, part B, 7.5 hp (MM5011)
• Classical Physics, 30 hp (FK3014)
• Quantum Mechanics, 7.5 hp (FK5020)
• Programming, numerical methods and statistics for physicists, 15 hp (FK4026) or both of the courses Physics with digital tools, 7.5 hp (FK4025) och Probability theory and statistics for teachers, 7.5 hp (MT1011)
• Electromagnetism and waves, 7.5 hp (FK5019)

Course structure

Examination code	Name	Higher Education Credits
TEOR	Statistical mechanics and condensed matter	7
LABB	Laboration	0.5

Course content

This is a first course in Statistical Mechanics and Condensed Matter covering the basics of these subjects.

Thermodynamics is discussed from the microscopic (statistical-mechanical) point-of-view.
Entropy, Free energy, Temperature, the Boltzmann distribution and Fermi and Bose gases

are introduced. Fundamental concepts in condensed matter- such as free electron theory, Fermi energy and Fermi surface, density of states, reciprocal lattice, crystal structure and phonons will also be discussed.

Techniques useful for the experimental studies of material structure will also be briefly touched upon.

This course consists of two parts

TEOR Statistical Mechanics and Condensed Matter 7 hp

LABB one laboratory session 0.5 hp

Learning outcomes

After completing the course the student will be expected to be able to:
• understand and explain how thermal properties of a macroscopic system can be derived from a microscopic description (TEOR)
• understand and use the mathematical methods which help in making the connection between a macroscopic and microscopic description of a system (TEOR)
• describe both the microscopic and macroscopic properties of ideal quantum gases (TEOR)
• use the concepts of density-of-states and reciprocal lattice to solve problems (TEOR)
• understand the basic concepts and models in condensed matter physics concerning electrons in metals, phonons and crystal structure (TEOR,LABB).

Education

The education consists of lectures,exercises and laboratory work.
Participation in laboratory work and any associated integrated instruction is compulsory. In the event of special circumstances, the examiner may, after consultation with the teacher concerned, grant a student exemption from the obligation to participate in certain compulsory instruction.

The course will be given in English if requested by any student enrolled.

Forms of examination

a. The course is examined as follows: knowledge assessment of the course unit TEOR takes the form of written exam and homework problems . The course unit LABB is examined with written and oral report.

If the instruction is in English, the examination may also be conducted in English.

b. Grades will be set according to a seven-point scale related to the learning objectives of the course:
A = Excellent
B= Very good
C = Good
D = Satisfactory
E = Adequate
Fx = Fail, some additional work required
F = Fail, much additional work required

The the course unit LABB will be
graded according to a two-point scale: Pass (G) or Fail (U).

c. The grading criteria will be distributed at the beginning of the course.

d. In order to pass the course, a minimum grade of E on course unit TEOR is required and grade Pass on course unit LABB as well as participation in all compulsory education.

e. Students who receive a failing grade on a regular examination are allowed to retake the examination as long as the course is still provided. The number of examination opportunities is not limited. Other mandatory course elements are equated with examinations. A student who has received a passing grade on an examination may not retake the examination to attain a higher grade. A student who has failed the same examination twice is entitled to have another examiner appointed, unless there are special reasons to the contrary. Such requests should be made to the department board.

The course includes at least two examination opportunities per year when the course is given. At least one examination opportunity will be offered during a year when the course is not given.

f. Students awarded the grade Fx are given the opportunity to improve their grade to E. The examiner decides the supplementary assignments to be performed and the pass mark criteria. The supplementary assignments will take place before the next examination session.

Interim

Students may request that the examination be conducted in accordance with this course plan even after it

has ceased to be valid. However, this may not take place more than three times over a two year period after course instruction has ended. Requests must be made to the departmental board. The provision also applies in the case of revisions to the course plan (and the revisions of the course literature).

Limitations

The course may not be included as a part of a degree together with the courses Statistical Physics I, 7.5 credits (FK8008) or Condensed Matter Physics I, 7.5 credits (FK7042) or equivalent.

Misc

The course is included in the Bachelor programme in Physics and the education for teachers. It can also be studied as a separate course.

Required reading

The course literature is decided by the department board and published on the Department of Physics's website at least two months before the start of the course.