

Syllabus

for course at advanced level

**Superconductivity
Supraledning**

**7.5 Higher Education
Credits
7.5 ECTS credits**

| | |
|--------------------------|---|
| Course code: | FK7053 |
| Valid from: | Autumn 2017 |
| Date of approval: | 2017-01-16 |
| Department | Department of Physics |
| Main field: | Physics |
| Specialisation: | A1N - Second cycle, has only first-cycle course/s as entry requirements |

Decision

This course plan has been established by the Board of Science at Stockholm University on 2017-01-16.

Prerequisites and special admittance requirements

Admission to the course requires knowledge equivalent to passed courses (excluding introductory courses) of 45 credits in mathematics and 60 credits in physics, where the courses Quantum Mechanics, 7.5 credits (FK5020) and Statistical Mechanics and Condensed Matter, 7.5 credits (FK5025) should be included. Additionally, requires knowledge equivalent to upper secondary school English B/English 6.

Course structure

| Examination code | Name | Higher Education Credits |
|------------------|-------------------|--------------------------|
| HELA | Superconductivity | 7.5 |

Course content

The course covers

- electric and thermodynamics properties of superconductors
- models that describe superconductors (London's linear electrodynamics, Ginzburg-Landau equations and microscopic theory of conventional (low-temperature) superconductors)
- vortices in superconductors
- high-temperature superconductors
- properties of superconducting tunnel (Josephson) junctions
- DC and AC Josephson-effects
- vortices and non-linear dynamics of Josephson junctions
- applications of superconductors: high-field magnets, SQUID's, rapid single-flux-quantum electronics, single-electron transistors, detectors, components for quantum computers.

Learning outcomes

After having passed the course the student is expected to be able to:

- describe basic electrical and thermodynamical properties of type I and type II superconductors
- apply theoretical models in order to solve physical problems within the science of superconductors
- describe quantum phenomena in superconducting tunneling transitions
- describe applications of superconductors in low temperature electronics

Education

The education consists of lectures 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 takes the form of written and oral exams, hands-in and written report of laboratory work. 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

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 is required.

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 in examinations in combination with course Superconductivity, 7.5 credits (FK7019) or equivalent.

Misc

The course can be included as part of the master's programs offered at the Physics department, but is also offered 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.