

Syllabus

for course at first level

Advanced Quantum Mechanics
Avancerad kvantmekanik

**7.5 Higher Education
Credits**
7.5 ECTS credits

Course code:	FK5027
Valid from:	Autumn 2019
Date of approval:	2016-08-23
Changed:	2016-08-23
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 credits (MM2002)
- Mathematics for Natural Sciences II, 15 credits (MM4001)
- Mathematics II - Analysis, part A, 7.5 credits (MM5010)
- Mathematics II - Analysis, part B, 7.5 credits (MM5011)
- Mathematics II - Linear Algebra, 7.5 credits (MM5012)
- Classical Physics, 30 credits (FK3014)
- Quantum Mechanics, 7.5 credits (FK5020)
- Programming, numerical methods and statistics for physicists, 15 credits (FK4026) or both of the courses Physics with digital tools, 7.5 credits (FK4025) och Probability theory and statistics for teachers, 7.5 credits (MT1011)
- Electromagnetism and waves, 7.5 credits (FK5019)
- Atomic and molecular physics, 7.5 credits (FK5023)

Course structure

Examination code	Name	Higher Education Credits
HELA	Advanced Quantum Mechanics	7.5

Course content

The course treats basic concepts and methods in non-relativistic quantum mechanics such as Dirac notation, Hermitian operators and Hilbert spaces; the connection between quantum mechanics and linear algebra; the generalised uncertainty principle; the time-dependent Schrödinger equation and wave packets; position and momentum representation; the connection between quantum mechanics and classical physics; time-dependent perturbation theory; basic scattering theory; quantum mechanical entanglement, Bell's inequality and an introduction to density matrices.

Learning outcomes

After completing the course the student will be expected to be able to:

- discuss basic problems regarding the interpretation of quantum mechanics
- discuss and apply the quantum mechanical formalism in various contexts

- discuss and apply time-dependent perturbation theory
- discuss and apply basic scattering theory
- discuss and analyse the connection between quantum mechanics and the classical limit
- describe quantum entanglement

Education

The education consists of lectures and exercises.

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 exam and home work problems.

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 as a part of a degree together with the courses Quantum Mechanics II, 7.5 credits (FK5012) and Quantum Mechanics III, 7.5 credits (FK8007).

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.