Faculty of Science

FYSN27, Physics: Quantum Mechanics, 7.5 credits

Fysik: Kvantmekanik, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2022-12-09 to be valid from 2022-12-09, autumn semester 2023.

General Information

The course is an elective course at the second-cycle level for a scientific candidate- or Degree of Master (120 credits) in physics and an elective course at the second-cycle level for a Degree of Master of Science (120 credits) in scientific computing with a specialisation in chemistry.

Language of instruction: English

Main field of studies	*Depth of study relative to the degree requirements*
Physics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The overall aim of the course is to provide an in-depth knowledge of quantum mechanics, which all physicists should have regardless of whether they are engaged in theoretical or experimental physics, since quantum mechanics is the basis of all modern physics. The course covers both theory and applications. Furthermore, it includes a project that gives training in some application of different fields in physics.

Knowledge and understanding

On completion of the course, the students shall be able to:

- give an account of the formalism and mathematical methods of quantum mechanics and apply them to concrete problems.

Competence and skills

On completion of the course, the students shall be able to:

- use the methods of quantum mechanics for analysis and calculation of relevant physical problems
- apply quantum mechanical thinking on concrete problems
- give an account of a quantum mechanical application based on scientific literature
- work independently with literature on a quantum mechanical problem in current research.

Judgement and approach

On completion of the course, the students shall be able to:

- provide arguments for the usefulness of quantum mechanical theory in some applications
- identify a physics question and provide arguments for its quantum mechanical description based on scientific literature.

Course content

The course covers the formulation of quantum mechanics in terms of operators and state vectors. The course covers the Schrödinger equation, identical particles, continuous spectra, the Heisenberg picture, angular momentum and symmetries as well as approximation methods. Applications are made on simple systems e.g. two-level systems, quantum dots, atomic nuclei, Bose-Einstein condensates or system in external fields.

Course design

The teaching consists of lectures and exercises and a project work that is presented at a seminar. Active participation in the project work and the seminar is compulsory.

Assessment

Assessment takes the form of a written exam at the end of the course as well as orarlly and in writing in the form of a project during the course.

Students who do not pass a regular assessment will be offered another opportunity for assessement soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
For a Pass grade on the whole course, the student must have Pass grade in written exam.

The grading scale for the written assignments is Failed, Passed, while examination is

graded according to the grading scale failed, passed, Passed with distinction.

The final grade is decided by the grade on the exam.

Entry requirements

Admission to the course requires 75 credits in physics and 45 credits in mathematics including knowledge equivalent to FYSB22 Basic Quantum Mechanics, 7.5 credits and FYSB24 Atomic and Molecular Physics, 7.5 credits, - or a bachelor's degree in physics or equivalent, including knowledge equivalent to FYSB22 Basic quantum mechanics, 7.5 credits. Furthermore is required English 6/B as well as general entry requirements.

Further information

This course replaces FYSN17, Physics: Quantum Mechanics, 7.5 credits and cannot be included in a degree together with this course.

The course is in full coordinated with FFFN01, Nanomaterials - Thermodynamics and Kinetics, 7.5 credits which is a course given at Lund Institute of Technology, LTH.

The examination of the course is scheduled in accordance with the LTH exam schedule.

The course is offered at the Department of Physics, Lund University.

Subcourses in FYSN27, Physics: Quantum Mechanics

Applies from H23

2301 Written exam, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction
2302 Project work, 1,5 hp
Grading scale: Fail, Pass