Quantum Mechanics I, 7.5 credits

Kvantmekanik I, 7.5 hp

Third-cycle education course

6FIFM22

Department of Physics, Chemistry and Biology

Valid from: First half-year 2024

Approved by **Approved**

Registration number

Entry requirements

Entry requirement for studies on third-cycle education courses

- second-cycle degree,
- 240 credits in required courses, including at least 60 second-cycle credits, or
- acquisition of equivalent knowledge in some other manner

Specific entry requirements for this course:
Undergraduate course in quantum mechanics or in Modern Physics

Specific information

On the student's request, course certificate is issued by the course examiner

Learning outcomes

By the end of the course the students will be able to:

- get knowledge about the main concepts and methods of wave mechanics
- understand and use the concept of spin
- get knowledge about Dirac formulation of quantum mechanics
- get knowledge about angular momentum eigenvalue problem
- solve Schrödinger equation for free particles, particles in the box, harmonic oscillator, particles in electromagnetic field and particles in potentials with discontinuities
- apply approximative methods of quantum mechanics such as variational methods and time-independent perturbation theory
- model molecular and periodic structures using methods of quantum mechanics
- summarize, represent and discuss special topics of quantum mechanics

Contents

The course contains an exposition of the basic principles of quantum mechanics and its applications. The course begins with the basic concepts of quantum mechanics with emphasis on the wave mechanics and its physical interpretation. The exact solutions of the Schrödinger equation are used for the consideration of the most important quantum-mechanical system such as free particle, charged particle in an electromagnetic field, harmonic oscillator, particle in potentials with discontinuities. Then the approximate methods of quantum theory are introduced and discussed using the basic ideas of the perturbation theory and variational principle. These methods are applied for the consideration of a number of more complicated problems linked mainly with modelling of molecular and periodic structures. A special attention is paid to the Dirac formulation of quantum mechanics and its application to the general problems of measurement, quantization, angular momentum and spin.

Educational methods

The course contains lectures and seminars.

Examination

Examination contains solution of the home assignments and oral presentation.

Grading

Two-grade scale

Course literature

E. Merzbacher. Quantum mechanics, 3rd edition, John Wiley and Sons, 1998.

General information

The course is planned and carried out according to what is stated in this syllabus. Course evaluation, analysis and suggestions for improvement should be fed back to the Research and PhD studies Committee (FUN) by the course coordinator.