Faculty of Technology and Science
Physics

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Technology and Science on 15 November 2012 , and is valid from the Autumn semester of 2012 at Karlstad University. It replaces the former syllabus from 27 May 2008, Reg No: FAK2 2008/9:15.

Course Code: FYGC01
Quantum Physics II, 7.5 ECTS Credits
(Kvantfysik II, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G2F (First cycle, has at least 60 credits in first-cycle course/s as entry requirements)

Language of Instruction
Swedish or English.

Prerequisites
Physics 45 ECTS cr and Mathematics 30 ECTS cr, including Quantum Physics I, Linear Algebra and Mathematical Physics I, or equivalent.

Major Field of Study
FYA (Physics)

Learning Outcomes

The aim of the course is that the students acquire advanced knowledge and comprehension of quantum mechanics and its methods, and develop their skills in mathematically analyzing quantum mechanical systems.

Upon completion of the course, students should be able to:
- give an account of the most important approximation methods for time-dependent problems in quantum mechanics and their respective areas of validity, as well as demonstrate proficiency in their application,
- give an account of dipole approximation and dipole active transitions,
- give an account of the quantum mechanical description of several- and many-particle systems and demonstrate proficiency in the computation of multi-electron atoms and simpler molecules,
- give an account of atomic and molecular orbitals and chemical bonds.
- give an account of and analyze the interaction of quantum physical systems with electromagnetic radiation and with external electric and magnetic fields,
- give an account of the central concepts of statistical quantum mechanics and be able to perform basic quantum mechanical computations of the most important statistical ensembles,
- name and reflect on some central problems concerning the interpretation of quantum mechanics
- conduct basic spectroscopic experiments and analyze and interpret the obtained results.

Content and Form of Instruction

The harmonic oscillator and applications, step operators. Several- and many-particle systems, especially fermion systems. Time-independent and time-dependent perturbation theory and selection rules. The interaction of quantum systems with electromagnetic radiation as well as with external electric and magnetic fields. Atomic and molecular orbitals, chemical binding. Quantum statistics, and applications of quantum physics. The measurement problem of quantum physics. Laboratory assignments in the spectroscopy of atoms, molecules, and solid materials.

Reading List

See separate document.

Examination

Assessment is based on a written exam, presentation of laboratory assignments, and hand-in assignments.

Grades

One of the grades Fail (U), Pass (G), or Distinction (VG) is awarded in the examination of the course. For students in engineering programs the grades Fail (U), Pass (3), Some Distinction (4), or Distinction (5) are used.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure improvement. Course assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor's and Master's levels at Karlstad University stipulate the obligations and rights of students and staff.

The course is a mandatory part of the program Master of Science in Engineering, Degree Programme in Engineering Physics.

Karlstads universitet 651 88 Karlstad, Sweden
Tel +46-54-700 10 00 Fax +46-54-700 14 60
information@kau.se www.kau.se