Reg No: FAK2 2008/9:15

Faculty of Technology and Science
Physics

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Technology and Science on 27 May 2008, and is valid from the Autumn semester of 2007 at Karlstad University.

Course Code: FYGC01
Quantum Physics II, 7.5 ECTS Credits
(Kvantfysik II, 7.5 Swedish credit points)
Degree Level: Bachelor
Progression Level: C

Language of Instruction
The language of instruction is Swedish or English. Contact the course coordinator for further information.

Prerequisites
For acceptance to the course the equivalent of 60 ECTS Credits in mathematics and 60 ECTS Credits in physics are required.

Major Field of Study
Physics

Aims

The goal of the course is that the students shall be able to demonstrate 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 ought to 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 be proficient in their application
- give an account of the quantum mechanical description of several- and many-particle systems and be proficient in computations for 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
- apply some important approximation methods for the analysis of scattering processes
- 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
- give an account of the Dirac equation and its historical significance, and apply it in the analysis of the fine structure of the hydrogen atom
- give an account of some central problems concerning the interpretation of quantum mechanics
- conduct basic spectroscopic experiments and analyze and interpret the obtained results.

Course Content

Several- and many-particle systems, especially fermion systems. The interaction of quantum systems with electromagnetic radiation as well as with external electric and magnetic fields. Atomic and molecular orbitals, chemical binding, particle scattering, quantum statistics, and relativistic quantum mechanics. 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

Examination is in the form of 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, ref. C2007/368, 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.

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