12998-334(16) Quantum Mechanics A
(Quantum mechanics with applications) (3l, 3p)

2014

Course summary:

Schrödinger equation in three dimensions; particle in a box; spherically symmetric potentials, orbital angular momentum: Eigenvalues and spherical harmonic functions. The hydrogen atom. Electrons in periodic crystal potentials, time-independent perturbation theory, spin and application to the atom.

Continuous assessment
PP Physics 224
P Physics 254
P Mathematics 214, 244

Outcomes of course:

The student is skilled in the practical application of quantum mechanical principles in three dimensional microscopic systems like nuclei, atoms and crystals.

Lecturer:

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Course content:

Revision
- Uncertainty principle
- Statistical interpretation
- Schroedinger equation
- Stationary states

Quantum mechanics in three dimensions
- Schroedinger equation in spherical coordinates
- Hydrogen atom
- Angular momentum
- Spin

Identical particles
- Two and more particle systems
- Bosons and fermions—Pauli's exclusion principle
- Applications in solids
  - Free electron gas
  - Band structure

Time-independent perturbation theory
- Non-degenerate perturbation theory
- Degenerate perturbation theory
- Applications
  - Fine structure of Hydrogen
  - Zeeman effect
  - Hyperfine splitting

Variational principle
- Theory
- Applications
  - Ground state of Helium atom

Practical (Tutorials):

One tutorial per week for 13 weeks

Study material:

DJ Griffiths: ***Introduction to Quantum Mechanics***

Assessment:

Methods of Assessments

Venue and time of assessment opportunities
See ***timetable*** on Physics home page

Availability of marks:

Calculation of final mark for the module:
Two short (15 minutes) *oral examination testing concepts and the relation to other courses* (taken individually by a student with at least one other colleague present) – allows accurate estimation of true conceptual understanding of student, as well as providing the appropriate feedback to the student at the time of the oral examination. Counting 1/3 of final mark.

- Six in-class *advanced calculation assignments performed individually* to test and develop the relevant algebraic skills. *Marking schemes will be worked out with the students afterwards, who will mark each others' work and which will be moderated by the lecturer.* Counting: 3/5 of final mark.

- Three group problem solving sessions with presentation. Peer groups vote on grade “Excellent”, “Satisfactory” or “Unsatisfactory”. Counting 1/15 of final mark.