

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

2015

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:

Prof H Weigel

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See also: http://www.physics.sun.ac.za/~weigel/announce_334.html

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
- Periodic table of the elements
- 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:

prescribed textbook:

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

additional textbooks will be recommended in class.

Assessment:***Methods of Assessments***

(approx. weekly) homework assignments:	25%
short oral exams (2):	25%
test (March 24 th):	25%
exam (May 28 th):	25%

Venue and time of assessment opportunities

See ***timetable*** on Physics home page and http://www.physics.sun.ac.za/~weigell/announce_334.html

Availability of marks: