**Advanced Quantum Mechanics (3 credits): PH3203**

Short Introduction: This is a core course for undergraduate students (BS-MS/PBIP) where various important applications of (non-relativistic) quantum mechanics and approximation techniques are covered.

The main contents of this course are scattering theory, basic atomic and nuclear physics and basic quantum optics. The main aim of this course is to give an exposure and broad overview of different areas of quantum physics and to introduce new techniques which can be useful for further studies on more advanced and focused topics. (This course would be useful for advanced courses like 'atomic and molecular physics', 'quantum optics', 'field theory' and 'quantum information theory').

Credit: 3 (3-0-0)

Prerequisites: Intermediate Quantum Mechanics, Intermediate Classical Mechanics, Mathematical methods of Physics

Course Outline: Scattering theory, special topics of single particle atomic and nuclear physics,second quantization, interaction of atom with radiation field.

Syllabus:

* Scattering theory: scattering from spherical symmetric potential and partial wave, Born approximation etc.
* Some special topics of single particle atomic and nuclear physics: shell effect and shell model, Stark and Zeeman effect , Spin-Orbit and other hyperfine interactions etc.
* Many identical particles: Symmetric and antisymmetric wave-functions, Example:He atom
* Second quantization: Fock states, creation annihilation operators for bosons, coherent states.
* Interaction of atom with radiation field: Dipole coupling, atom as a two level system and Rabi oscillation etc.

Long list of References:

1. Quantum Mechanics Vol. II, Claude Cohen Tannoudji, Wiley-VCH.
2. Quantum Mechanics, B. H. Bransden and C. J. Joachain, Prentice Hall.
3. Introductory Quantum Optics, C. Gerry and P. Knight, Cambridge University Press.
4. The Quantum Theory of Light, R. Loudon, Oxford Science Publications.

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