

Basic Sciences PhD Coursework

Course Code. :	PH 227002 Ph.D.
Course Title :	Atomic, Molecular & Optical Physics
Credits:	L T P C 3 0 0 3
Prerequisites (if any)	Nil
Course Coordinator	Dr. Dheeraj Kumar Singh (Physics)
Course Objective	The course “Atomic, Molecular & Optical Physics” is designed to provide the fundamental and advanced level understanding of the properties, dynamics and interactions of the basic building blocks of material as it is encountered in everyday life. This fundamental courses may provide a nice platform for working in academic/industrial research.
Course Contents	<p>Quantum states of an electron in an atom, Electron spin, Stern-Gerlach experiment, Spectrum of helium and alkali atom, Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines.</p> <p>LS & JJ couplings, Zeeman, Paschen-Bach & Stark effects, Electron spin resonance, Nuclear magnetic resonance, Chemical shift, Frank-Condon principle, Born-Oppenheimer approximation,</p> <p>Raman spectroscopy analysis, Electronic, rotational, vibrational and Raman spectra of diatomic molecules, Selection rules.</p> <p>Lasers: Spontaneous and stimulated emission, Einstein A & B coefficients, Optical pumping, population inversion, Rate equation, Modes of resonators and coherence length.</p>
Text books/ References	<ol style="list-style-type: none"> 1. Atomic & Molecular Physics: Rajkumar, Kmrn 2012. 2. Introduction to Atomic and Nuclear Physics: H.E. White, D. Van Nostrand Company, Inc.; Later Printing edition, 1966. 3. Fundamentals of Molecular Spectroscopy: C.N. Banwell, McGraw Hill Education; 4th Edition, 2017. 4. Modern Spectroscopy: J.M. Hollas, 4th Edition, John Wiley & Sons Ltd, 2004. 5. Laser Spectroscopy- Basic Concepts and Instrumentation: W. Demtröder, 3rd Edition, Springer, 2003 6. Optics: A. Ghatak, 4th Edition, 2009. 7. The elements of Physical Chemistry: P. Atkins, J.D. Paula, Oxford, 2017.