Semester	JAN 2022
Open to semester	8,14,22
Course code	**PHY420/PH6254**
Course title	**Atomic and Molecular Physics**
Credits	4 /4
Course Coordinator & participating faculty (if any)	T. S. Mahesh
Nature of Course	Lectures
Pre-requisites	Quantum Mechanics I and II
Objectives (goals, type of students for whom useful, outcome etc)	Quantum theoretical approach to understanding atoms, molecules, and their interactions with one another, as well as with electric, magnetic, and electromagnetic fields. Attempts will be made to highlight important experiments. Applying theoretical concepts via solving problems is encouraged.
Course contents (details of topics /sections with no. of lectures for each)	1. Quantum theory of single-electron atoms. 2. Single-electron atoms in electromagnetic fields, fine and hyperfine structures, Stark effect, Zeeman effect. 3. Quantum theory of two-electron atoms, the influence of orbital and spin angular momenta; their excited states. 4. Quantum theory of multi-electron atoms, central field approximation, the periodic table, Thomas-Fermi and Hartree-Fock models, L-S and J-J coupling. 5. Molecules, Born-Oppenheimer approximation, diatomic molecules and their energy levels, polyatomic molecules and their structure. 6. Electronic, vibrational, and rotational degrees of freedom; optical, infrared, Raman, microwave, magnetic resonance, X-Ray spectroscopy. 7. Interaction of atoms/molecules with electromagnetic radiation, dipole approximation, oscillator strengths, Masers and Lasers, Einstein coefficients, atom optics, trapping atoms and ions, laser cooling, BEC, atomic clocks 8. Electron-Atom, Ion-Atom, Atom-Atom Collisions
Evaluation /assessment	End-Sem Examination-35% Mid-Sem Examination-35% Others-30%
Suggested readings (with full list of authors, publisher, year,	1. Physics of Atoms and Molecules, B H Bransden and C J Jochain, Pearson International (2011) 2/e

edn etc.)	2. Atoms Molecules and Photons, W Demtroder, Springer (2010) 2/e 3. Atoms, Molecules, and Lasers, K P R Nair, Narosa (2006)