

Lesson Plan (2025-26)
B.Sc.-Physics
Semester -VI (Even)
PHY.- 601 - ATOMIC MOLECULAR AND LASER PHYSICS

Jan. 2026	Unit -I
	Vector atom model, quantum numbers associated with vector atom model, penetrating and non- penetrating orbits (qualitative description), spectral lines in different series of alkali spectra, spin orbit interaction and doublet term separation LS or Russell-Saunders Coupling jj coupling (expressions for interaction energies for LS and jj coupling required).
Feb. 2026	Unit-II
	Zeeman effect (normal and Anomalous) Zeeman pattern of D ₁ and D ₂ lines of Na-atom, Paschen, Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom. Discrete set of electronic energies of molecules. quantisation of Vibrational and rotational energies Raman effect (Quantitative description) Stokes and anti Stokes lines.
March + April	Unit-III
	Main features of a laser : Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification, momentum transfer, life time of a level, kinetics of optical absorption. Threshold condition for laser emission, Laser pumping, He-Ne laser and RUBY laser (Principle, Construction and Working). Applications of laser in the field of medicine and industry.
April + Up to 10 May	Internal Assessment + Revision Test

References

1. Introduction to Atomic and Molecular Spectroscopy by V.K.Jain, Narosa (2007)
2. Introduction to Atomic Spectra by H.B. White.
3. Atomic spectra by G. Herzberg.
4. Molecular Spectra and Molecular Structure by G. Herzberg.
5. Fundamentals of molecular spectroscopy by Colin N. Banwell and Elaine M. Mc-Cash.
6. Lasers, Theory and Application (2nd Ed.) by Thagrajan and Ajay Ghatak.
7. Laser and Nonlinear Optics by B.B. Laud (2nd Ed.)
8. Introduction to Optics by Frank L. Pedrotti and Lens S. Pedrotti, Prentice Hall, 1987.

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B.Sc.-Physics
Semester -VI (Even)
PHY.- 602- NUCLEAR PHYSICS

Jan. 2026	Unit-I
	Nuclear mass and binding energy, systematics nuclear binding energy, nuclear stability, Nuclear size, spin, parity, statistics magnetic dipole moment, quadrupole moment (shape concept), Determination of mass by Bain-Bridge, Bain-Bride and Jordan mass spectrograph, Determination of charge by Mosley law Determination of size of nuclei by Rutherford Back Scattering.
Feb. 2026	Unit-II
	Interaction of heavy charged particles (Alpha particles), alpha disintegration and its theory Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Energetics of alpha -decay, Range and straggling of alpha particles. Geiger-Nuttal law. Introduction of light charged particle (Beta-particle), Origin of continuous beta-spectrum (neutrino hypothesis) types of beta decay and energetics of beta decay, Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles. Interaction of Gamma Ray, Nature of gamma rays, Energetics of gamma rays, passage of Gamma radiations through matter (photoelectric, compton and pair production effect) electron position annihilation. Asborption of Gamma rays (Mass attenuation coefficient) and its application.
March 2026	Unit-III
	Nuclear reactions, Elastic scattering, Inelastic scattng, Nuclear disintegration, photoneuclear reaction, Radiative capture, Direct reaction, heavy ion reactions and spallation Reactions, conservation laws. Q-value and reaction threshold. Nuclear Reactors General aspects of Reactor design. Nuclear fission and fusion reactors (Principles, construction, working and use) Linear accelerator, Tendem accelerator, Cyclotron and Betatron accelerators. Ionization chamber, proportional counter, G.M. counter detailed study, scintillation counter and semiconductor detector.
April + Up to 10 May	Internal Assessment + Revision Test

references :-

1. Atomic and nuclear Physics, Vol. II by S.N. Ghashal.
2. Nuclear Physics by D.C. Tayal, Umesh Prakashan, 125, Goblind Dev Khurja (UP).
3. Concept of Modern physics by arther Besier, Tata McGraw Hill Publications.
4. Nuclear Physics by W.E. Burcham.
5. Nuclear Radiation Detectors by S.S. Kapoor
6. Experimental Nuclear Physics by M. Singru.


 Dr. Satya Prakash