

M. Sc. II Year		MPH-C302			Semester-III
		ATOMIC & MOLECULAR PHYSICS			
Total Lectures	Time Allotted for End Semester Examination	Marks Allotted for Continuous Assessment	Marks Allotted for End Semester Examination (ESE)	Maximum Marks (MM)	Total Credits
60	3 Hrs	30	70	100	04

NOTE: The question paper shall consist of two sections (Sec.-A and Sec.-B). Sec.-A shall contain 10 short answer type questions of six marks each and student shall be required to attempt any five questions. Sec.-B shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT-I

SPECTRA OF ALKALI & ALKALINE ELEMENTS AND X-RAY SPECTRA

Quantum states of an electron atoms, Atomic orbitals, Pauli's principle, Different series in alkali spectra, Term values and quantum defect, Ritz combination principle, Penetrating and non-penetrating orbits, Spin orbit interaction, Spectra of alkali and alkaline elements, Energy state of helium atom, Spectra of helium and mercury, Characteristics of X-ray spectra, Fine structure of X-ray levels, Spin relativity doublets, Fluorescence yield and Auger effect. (12 Lectures)

UNIT-II

COMPLEX SPECTRA

Hamiltonian of complex spectra atom, L-S and J-J coupling, Term values in equivalent and non-equivalent electron systems, Hund's rule, Lande interval rule, Energy level diagrams and selection rules in complex spectra, Regularities in complex spectra, Fine and Hyperfine structure of spectral lines, Zeeman effect, Paschen-Back effect and Stark effect. (12 Lectures)

UNIT-III

MOLECULAR BINDING AND ROTATION -VIBRATION SPECTRA

Molecular orbital method, The hydrogen molecule ion, Van der-Waals forces for H-atom, Born and Oppenheimer approximation, Rotational spectra of linear and diatomic molecules, Vibrating diatomic molecule, Molecule as anharmonic oscillator, Fine structure of vibration-rotation bands, Vibrational spectra of YX_2 type molecules, Isotope effects in vibrational bands. (12 Lectures)

UNIT-IV

ELECTRONIC AND RAMAN SPECTRA

Frank-Condon principle, Vibrational coarse structure, Rotational fine structure of electronic vibration transition, Raman spectra : Classical and quantum theory of Raman effect, Rotational Raman effect, Structure determination from Raman and IR spectroscopy. (12 Lectures)

UNIT-V

LASERS

Spontaneous and stimulated emission, Temporal and spatial coherences, Pumping process, Types of Laser: Solid state Laser (Ruby), Gas Lasers (Helium-Neon and Carbon dioxide) and Semiconductor laser (Ga-As), Population inversion, Properties of Laser beams, Laser Applications : Distance measurement, Laser interferometry, Holography. (12 Lectures)

Text Books / Reference Books

1. Introduction to Atomic spectra- H.E. White
2. Fundamentals of molecular spectroscopy - C. B. Banwell
3. Molecular spectroscopy - J.M. Brown
4. Introduction to Molecular Spectroscopy - G.M. Barrow
5. Spectra of atoms and Molecules- Jeanne L. McWale
6. Lasers- B.B. Laud
7. Principles of Lasers- O. Svelto