1. Subject code: **EP- 305** Course title: **Atomic and Molecular Physics**

2. Contact Hours: L: 3 T: 1 P: 0

3. Examination Duration (Hrs): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25, PRS:--, MTE: 25, ETE: 50, PRE: --

5. Credits: 4

6. Semester: ODD

7. Subject area: DEC-1

8. Pre-requisite: Basic knowledge of Atoms and Molecules

9. Objective: The course provides basic understanding of the Nature, essential principles, fundamental techniques and their prospective applications

10. Detail of Course:

**5th Semester**

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| **S. No.** | **Contents** | **Contact Hours** |
| 1. | Bohr-Sommerfeld theory of Hydrogen Atom, Quantum mechanics of Hydrogen atom: Angular momentum & Parity, Magnetic dipole moments, Electron spin and Vector atom model, Spin orbit Interaction: Hydrogen fine structure, Identical particles & Pauli’s principle | **10** |
| 2. | Spectroscopic terms: L-S & j-j couplings, Spectra of alkali elements, Spectra of alkaline earth elements, Zeeman effect, Paschen-Back effect, Stark effect, Hyperfine structure of spectral lines, Breadth of Spectral lines, X-ray spectra, Fine structure in X-ray emission spectra, X-ray spectra and optical spectra | **11** |
| 3. | Rotational spectroscopy: Rigid rotor, Rotational spectra of diatomic molecules, Intensities of spectral lines, Isotope effects, Non-Rigid Rotator, Rotation levels of polyatomic molecules: spherical, symmetric, and Asymmetric top molecules | **07** |
| 4. | Vibrational spectroscopy: Vibration of diatomic molecules, Harmonic oscillator and Anharmonic oscillator, Vibrational-rotational couplings, Vibration of polyatomic molecules | **06** |
| 5. | Electronic spectroscopy: Electronic spectra of diatomic molecules, vibrational coarse structure, Franck-Condon Principle, Dissociation energy and dissociation products, Rotational fine structure of Electronic-Vibration transition, Production of excited state, Radiative processes, Kasha’s Rule, Luminescence, Photoluminescence, kinetics, Quantum yield and lifetime | **08** |
|  | **Total** | **42** |

**Suggested Books**

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| **S. No.** | **Name of Books/ Authors** | **Year of publication/ Reprint** |
| **1.** | Introduction to Atomic Spectra, by Harvey Elliott White | 1934/McGraw Hill |
| **2.** | Principles of Modern Physics, by Robert B. Leighton | 1959/McGraw Hill |
| **3.** | Molecular spectra and molecular structure I, II and III. Spectra of diatomic molecules by G. Herzberg | 1939/Prentice-Hall |
| **4.** | Fundamentals of molecular spectroscopy by C. N. Banwell and E.M. McCash | 1994/McGraw Hill |
| **5.** | Principles of fluorescence spectroscopy by J.R. Lakowicz. | 1983/Springer |