

21PHY1C3L

M.Sc. I Semester Degree Examination, April/May - 2023

PHYSICS

Atomic, Molecular and Optical Physics

(CBCS)

Time : 3 Hours

Maximum Marks : 70

Note : Answer **any five** of the following questions with Question No. **1 (Q.1) compulsory**, each question carries **equal** marks.

1. (a) What is spin orbit interaction ? Obtain the general expression for spin-orbit interaction energy.
(b) What is fundamental series in alkali spectra ? Show that the intensity ratio of compound doublet of the fundamental series in alkali spectra is 1:20:14. **8+6=14**
2. (a) What is Paschen-Back effect ? Obtain the expression for magnetic interaction energy for a single valence electron atom in Paschen-Back effect.
(b) State and prove Lande Interval rule. **9+5=14**
3. (a) What is rigid rotator ? Obtain the expression for rotational energy of rigid rotator in terms wavenumber and hence sketch the rotational levels.
(b) Explain the working principle of infrared spectrometer. **9+5=14**
4. (a) Explain the intensities of vibrational-electronic spectra based on Franck-Condon principle.
(b) Explain the quantum theory of Raman effect. **9+5=14**
5. (a) Describe the theory of amplification of light.
(b) Explain the construction and working of carbon dioxide laser. **7+7=14**
6. (a) Discuss j-j coupling scheme in case of two valence electron atoms and derive the expression for interaction energy in this case.
(b) Explain the intensity of spectral lines in rotational spectra. **8+6=14**

P.T.O.

7. (a) Give the theory of pure rotational Raman spectra of linear molecules.
(b) Explain the application of laser in isotope separation. **9+5=14**
8. (a) Calculate the magnetic moment of atom in the states $^2p_{3/2}$ and $^2s_{1/2}$ in Bohr magneton. **4+5+5=14**
(b) Explain the construction and working of microwave spectrometer.
(c) State Born-Oppenheimer approximation and list out the properties of laser light.

- o o o -

