

July 2018
M. Sc. IInd Semester Examination

PHYSICS
Paper IV : Atomic and Molecular Physics

Time 3 Hours

(Max. Marks : Regular 85 / Private 100)

Note : This question paper is meant for all Regular and Private students. Answer all five questions. All questions carry equal marks. The blind candidates will be given 60 minutes extra time.

1. What are penetrating and non penetrating orbits ? Discuss with special reference to alkali atoms. Show that quantum defect in a penetrating orbit is a function of azimuthal quantum number but is independent of total quantum number.

OR

Discuss Thomas Fermi Statistical Model by writing its assumptions and necessary mathematical steps. What are the findings of the above model with respect to radius of atom, Z , electrons charge distribution and potential at atomic radius. <http://www.davvonline.com>

2. Obtain an expression for rotational energy level of a diatomic molecule, taking it as a rigid rotator. Discuss its spectrum and the relevant selection rule.

OR

(a) Discuss isotope effect in rotational spectra.

(b) The $J = 1 \leftarrow 0$ transition in HCl occurs at 10.68 cm^{-1} . Regarding the molecule to be rigid rotator, calculate the wavelength of the transition $J = 15 \leftarrow 14$.

3. Describe I. R. Spectrometer with following headings :

- (a) Block Diagram
- (b) Radiation Source
- (c) Sample
- (d) Detectors.

OR

Describe Vibrational Spectrum of diatomic molecule as non rigid rotator and anharmonic oscillator explaining spectrum with P, Q and R branches.

4. Discuss the main features of the vibrational and rotational Raman Spectra of diatomic molecules. What light does it throw on structure of the molecules ?

OR

What is Mössbauer Spectroscopy ? On what principle is it based ? How is Mössbauer effect studied ?

5. Write short notes on any two of the following :

- (a) Line Broadening Mechanism.
- (b) Intensity of Rotational Lines.
- (c) Photo Electron and Photo Acoustic Spectroscopy.
- (d) Photo Electron Spectroscopy.