

Total No. of Questions :4]

**P727**

SEAT No. :

[Total No. of Pages : 2

**[5315]-316**

**T.Y.B.Sc.**

**PHYSICS**

**PH-334 : Atomic and Molecular Physics  
(2013 Pattern) (Paper - IV) (Semester-III)**

*Time : 2Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of Logtables and Calculator is allowed.*

**Q1)** Attempt all of the following (one mark each).

**[10]**

- a) State any two limitations of Bohr's theory.
- b) State pauli's exclusion principle.
- c) What is ground state of an electron?
- d) State the values of  $m_l$  for  $l=4$ .
- e) State formula for wavelength of Balmer series.
- f) What is the conclusion of Frank -Hertz experiment?
- g) What is the physical significance of principal quantum number?
- h) Define equivalent electrons.
- i) State Bohr's first postulate in Bohr's theory.
- j) State formula for reduced mass of molecule.

**Q2)** Attempt any two of the following.

- a) What is Raman effect? Describe experimental set up to observe Raman spectra. **[5]**
- b) State and explain Lande Interval rule. Represent it graphically for  $^3D$  term. **[5]**
- c) Obtain an expression for rotational energy level of rigid diatomic molecule. **[5]**

**P.T.O.**

**Q3)** Attempt any two of the following.

- a) In an experiment of Raman effect using mercury green radiation of  $\lambda = 546.1 \text{ nm}$ , a stoke's line of wavelength  $554.3 \text{ nm}$  was observed. Find Raman shift and wavelength corresponding to anti-Stoke's line. [5]
- b) A sample of certain element is placed in 1 Tesla magnetic field and suitably excited. How far apart are the zeeman components of the  $5000 \text{ \AA}$  spectral line of this element?

Given:  $e = 1.6 \times 10^{-19} \text{ C}$ ,  $m = 9.11 \times 10^{-31} \text{ kg}$ ,  $c = 3 \times 10^8 \text{ m/s}$ . [5]

- c) The force constant of the bond in CO molecule is  $1956 \text{ N/M}$  Calculate the frequency of vibration of the molecule and the spacing between its vibrational energy levels in eV. [5]

Given:  $h = 6.63 \times 10^{-27} \text{ erg-sec}$ ,  $1 \text{ eV} = 1.6 \times 10^{-12} \text{ erg}$ .

$c = 3 \times 10^8 \text{ m/s}$ ,  $\mu = 1.16 \times 10^{-26} \text{ kg}$ .

**Q4)** a) Attempt any one of the following.

- i) What are x-rays? Discuss in detail production of characteristic x-ray spectra with energy level diagram. [8]
- ii) Obtain an expression for spin-orbit interaction energies for two valence electron system (LS coupling). [8]

b) Attempt any one of the following.

- i) What are 'L' and 'S' quantum numbers corresponding to  $^3D_2$ ? [2]
- ii) What is vibrational-rotational spectrum? [2]

