1604N181

Candidate's Seat No :_____

M.Sc Semester-2 Examination

407

Medical Physics

April-2024

Time : 2-30 Hours] **[Max. Marks : 70**

(ATOMIC AND MOLECULAR PHYSICS)

Q.1 (A) Define an orbital for an atom. Write about the spin-orbit interactions. [07]

(B) By Hartree and Hartree-Fock Method, what do you mean? Write about it. [07]

OR

Q.1 (A) Briefly describe the Thomas-Fermi Statistical Model. [07]

(B) Distinguish between j-j and L-S couplings. [07]

Q.2 (A) Explain selection rules and spectrum of a non-rigid rotator. [07]

(B) How molecular shape is classified? Discuss linear and spherical top molecules [07]

OR

Q.2 (A) Describe the rotational spectra of diatomic molecules as a rigid rotator. Prove that $\Delta\varepsilon = 2B(J+1)cm^{-1}$, where J = 0,1,2 and B is a rotational constant. [07]

(B) Write a descriptive note on intensity of spectral lines [07]

Q.3 (A) Draw a potential energy diagram of a vibrating diatomic molecule, and explain Morse potential energy diagram. [07]

(B) Discuss theory of diatomic molecules as simple harmonic oscillator. Show that potential energy $V(x) = \frac{1}{2}kx^2$ [07]

OR

Q.3 (A) Explain potential energy function of a diatomic molecule, and show that vibration frequency $\bar{\nu} = \frac{1}{2\pi C}\sqrt{\frac{k}{\mu}}$ cm^{-1} [07]

(B) Discuss vibrational energy of diatomic molecules with relevant expressions and diagram. [07]

Q.4 (A) What is a UV-Vis spectroscopy? Discuss principle and instrumentation of UV-Vis spectroscopy. [07]

(B) Write brief introduction about photo electron spectroscopy. Discuss principle and working of X-ray photo electron spectroscopy (XPS). [07]

OR

Q.4 (A) What is recoil energy. Discuss principle and instrumentation of Mossbauer spectroscopy. [07]

(B) What is a RAMAN spectroscopy? Discuss principle and instrumentation of RAMAN spectroscopic technique. [07]

Q.5 Answer in brief **Any Seven** questions from the following: (Each question is of **two** mark). [14]

P.T.O.

NIH – 2

(i) What is the exclusion principle of Pauli?
(ii) Write the energy and momentum operator equations.
(iii) State requirements that the wave equation must meet.
(iv) Calculate value of moment of Inertia (I) of HC ≡ CCl (chloroacetylene) and rotational constant-B. (r(C-H) = 1.0 Å, r (C=C) = 1.10 Å and r (C-Cl= 1.50 Å)
(v) What do you understand by symmetry tops molecules?
(vi) What is Zero-point energy?
(vii) Force constant can be expressed in dyne/cm (True/ False)
(viii) Write is a force constant.
(ix) Write two applications of UV-Vis spectroscopic technique.
(x) Write two applications of NMR technique.
(xi) Write name of Mossbauer parameters.
(xii) What is a RAMAN shift?

***** PAPER ENDS *****