M.Sc. II (Physics) (CBCS Pattern) Sem-III

PSCPHYT10 - Core Paper-X : Solid State Physics and Spectroscopy

P. Pages : 2 **GUG/W/22/11296**

Time : Three Hours * 3 8 1 1 * Max. Marks : 80

Either:-

1. 1) Calculate the packing fraction in crystal for **8**
a) S.C,
b) F.C.C
c) B.CC, in structure treating the atom as sphere.

2) What is reciprocal lattice? Give vector algebraic discussion of the reciprocal lattice. **8**

OR

a) Explain Miller indices with examples. **6**

b) Explain bonding of common crystal structure. **10**

Either:-

2. 1) Discuss point defect, line defects and stacking faults. **10**

2) Write a short note on polarization mechanisms. **6**

OR

a) Derive Clausius – Mossottie equation **8**

b) Explain presence of dislocation. Also discuss perfect and imperfect dislocations. **8**

Either:-

3. 1) Discuss quantum state of an electron in an atom. **6**

2) Discuss the relativistic corrections for energy levels of hydrogen atom. **10**

OR

a) Derive interaction energy in case of is and jj couplings. **8**

b) Define Franck-Condon principle. How does it monitor intensities in electronic bands? **8**

Either:-

4. 1) Explain Raman effect describe the theory and experimental set up to study Raman effect. **8**

2) In an experimental in the study of Raman effect using H2. green radiation of wavelength 546. 1nm, a stokes line of wavelength 554.3nm was observed. Find Raman shift. **4**

3) Describe the NMR Spectroscopy. **4**

OR

a) Explain the principle of ESR and its experimental technique. **6**

b) Show that the rotational energy of a diatomic molecule E is related to angular momentum L through the reaction $E = \frac{L^2}{2\mu r^{2'}}$ where μ is the reduced mass and r is the internuclear distance. **6**

c) The CO molecule has a bond length of 0.113m and mass of $_6C^{12}$ and $_8O^{16}$ atoms are 1.99×10^{-26} kg and 2.66×10^{-26} kg. Find energy in electron volt of the CO molecule when it is in the lowest rotational state. **4**

5. Attempt all the following:

a) Write a note on liquid crystal. **4**

b) Explain Ferro electricity. **4**

c) Write a short note on Auger transition. **4**

d) What are the salient features of molecular electronic spectra? **4**

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