M.Sc. (Physics) (CBCS Pattern) Third Semester

PSCPHYT10 - Solid State Physics And Spectroscopy Paper-10

P. Pages : 2 **GUG/W/18/11296**

Time : Three Hours * 3 3 9 9 * Max. Marks : 80

Notes : 1. All questions are compulsory.

1. Either

a) Explain 2D and 3D lattices in details. **8**

b) Explain the concept of point group, space group and Miller indices. **8**

OR

e) What are liquid crystals. Explain their types in details. **8**

f) Write a note on quasi crystal and glasses. **8**

2. Either

a) What is dislocation. Discuss Burger's vector and Burger circuit. **8**

b) What is defect? and explain their types. **8**

OR

e) What is : **8**

i) Slip Phane

ii) Slip direction

iii) Dislocation reaction

f) Write a note on piezo, pyro and ferroelectricity. **8**

3. Either

a) Explain the spectra of Helium atom and explain why the ground state of helium atom is very low lying. **8**

b) Explain the spectrum of alkali atom. **4**

c) Explain the hyperfine structure. **4**

OR

e) State and explain Franck - Condon principle. **8**

f) Explain the term LS and JJ coupling for a two electron system. **8**

is ℓ_1=2 and ℓ_2 =1 calculate

i) Total orbital momentum quantum number L.

ii) Total spin momentum quantum number S.

iii) Total angular momentum quantum J in L-S coupling.

iv) Multiplicity.

4. Either

a) Explain Raman effect. Describe the experimental set-up to study it. outline the theory of Raman effect. **8**

b) In an experiment in the study of Raman effect using H_2 green radiation of wave length 546.1 nm, a stokes line of wavelength 554.3 nm was observed. **4**
Find the Raman shift.
(Given : C =3x10^8 m/s)

c) Describe the NMR spectroscopy. **4**

OR

e) Explain the principle of ESR. further describe its experimental technique. **6**

f) Show that the rotational energy of a diatomic molecule E is related to angular momentum L. through the reaction **6**

$E = \frac{L^2}{2\mu r^2}$, where μ is reduced mass, r is internuclear distance.

g) The CO molecule has a bond length of 0.113 m 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. Answer the followings.

a) Determine Miller indices of a plane which cuts intercepts in the ratio. **4**

i) 1a : 3b : –2c ii) 4a : 6b : 3c
along the three axes.

b) Explain polarization mechanism. **4**

c) What is X-ray? Explain its types. **4**

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

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