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

PSCPHYT12-1 / PSCPHYT-12 - Foundation Course F1.1 - Fundamentals of Spectroscopy Paper-12

P. Pages : 2 **GUG/W/18/11304**

Time : Three Hours * 3 4 0 7 * Max. Marks : 80

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1. Either.

a) Derive an expression for Lande's splitting factor (g) and explain anomalous Zeeman effect. **8**

b) Explain Paschen-Back effect and stark effect. **8**

OR

e) Explain how atomic states are represented by L-S and J-J coupling schemes using vector diagrams. **8**

f) Describe Stern-Gerlach experiment. Show how it verifies the principle factures of vector atom model. **8**

2. Either.

a) Compare the rotational spectra of rigid and non-rigid diatomic molecules. **8**

b) Describe Born-Oppenheimer approximation. **8**

OR

e) Discuss the vibrational spectra of polyatomic molecule with example. **8**

f) Explain the vibrating diatomic molecule as anharmonic oscillator. **8**

3. Either.

a) Discuss the pure rotational Raman spectra. **8**

b) Discuss the main features of vibrational and notational Raman spectra of diatonic molecule. **8**

OR

e) Explain the main features of Raman spectrum of diatomic molecule. How it is used to explain the structure of diatomic molecule. **8**

f) Discuss the effect of Polarizability of the molecule on the Raman spectrum. **8**

4. Either.

a) Discuss the rotational fine structure of electronic vibrational transitions. **8**

b) Discuss the formation of PQR branches. The band head of the Q branch is always at $J = -\frac{1}{2}$ while that of P or R-branch may be anywhere, explain. **8**

OR

e) Discuss the phenomenon of fluorescence and phosphorescence. **8**

f) Discuss the sequence and progressions in the vibrational coarse structure of the band formed during electronic absorption and emission in molecules. **8**

5. Attempt all of the following.

a) The ground state of chlorine is $^2P_{3/2}$. Find its magnetic moment in terms of Bohr magneton (μ_B). In how many substrates will the ground state split in a weak magnetic field. **4**

b) What are the advantages of using FTIR spectrophotometer over conventional IR spectrophotometer. **4**

c) A substance shows a Raman line at 4567 $\overset{o}{A}$ when exciting line 4358 $\overset{o}{A}$ is used, Deduce the position of Stoke's and Auti-Stoke's line for the same substance when exciting line 4047 $\overset{o}{A}$ is used. **4**

d) What is Frank-Condon principle. **4**

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