M.Sc.(Chemistry) (CBCS Pattern) Semester-III

PSCHT09 - Spectroscopy-I

P. Pages : 2 **GUG/W/24/11331**

Time : Three Hours * 4 3 9 4 * Max. Marks : 80

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1. a) Discuss the symmetry elements and symmetry operation in detail. **8**

b) Derive the character table for the C2v point group using the great Orthogonality theorem. **8**

OR

c) Explain the reducible and irreducible representation. **4**

d) Discuss different symmetry operations in H_2O molecules. **4**

e) Discuss the multiplication table of the C_3v point group. **4**

f) Identify the point group of the following molecules. **4**

i) CH_4 ii) NO_2

iii) PCl_5 iv) BF_3

2. a) Discuss the different types of fission processes in mass spectroscopy. **8**

b) Discuss the principle and application of Mossbauer spectroscopy. **8**

OR

c) Explain the McLafferty rearrangement reaction with the mechanism. **4**

d) Predict molecular ion peak, base peak and metastable peak obtained in the mass spectrum of 2 – phenyl ethanol. **4**

e) Explain hyperfine magnetic splitting. **4**

f) Define isomer shift in Mossbauer spectroscopy. **4**

3. a) Explain the following term. **8**

i) Stark effect.

ii) Effect of substitution on transition frequencies.

b) Discuss the principle and instrumentation of Electron Spin Resonance (ESR) spectroscopy. **8**

OR

c) Describe the microwave spectrometer. **4**

d) What is a rigid motor? Derive the equation of moments of inertia and rotation energy. **4**

e) Explain the ESR spectra of naphthalene. **4**

f) Write a note on Kramer's degeneracy. **4**

4. a) Discuss following. **8**

i) Morse potential energy function.

ii) Isotopic effect in IR spectroscopy.

b) Discuss the quantum and classical theory of Raman effect. **8**

OR

c) Explain the P, Q and R branches in IR spectroscopy. **4**

d) Distinguish the following compound based on IR spectra. **4**

i) $C_6H_5-COCH_3$ & $C_6H_5-CH_2OH$

ii) CH_3-CH_2OH & CH_3-CH_2-COOH

e) Explain how Raman and IR are complementary to each other. **4**

f) Discuss the rotational Raman spectra of diatomic molecules. **4**

5. a) List various symmetry elements in the CH_4 molecule. **2**

b) Write application of group theory in electronic spectroscopy. **2**

c) Give the principle of Mass spectroscopy. **2**

d) Write a short note on Mossbauer source. **2**

e) Give the selection rule for microwave spectroscopy. **2**

f) Give the ESR lines in the ESR spectrum of hydrogen-free radicle. **2**

g) Why are homonuclear diatomic molecules IR inactive and Raman active. **2**

h) How will you differentiate the isomers having molecular formula C_3H_6O on the basis of IR spectroscopy? **2**

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