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

PSCHT09 - Paper-IX : Spectroscopy

P. Pages : 2 **GUG/S/23/11331**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions are compulsory.
2. All questions carry equal marks.
3. Use of calculator is allowed.
4. Draw labelled diagrams wherever necessary.

1. a) Discuss the character table of H_2O molecules by using great orthogonality theorem. **8**

b) Discuss the application of character table in selection rules of 1R and Raman spectroscopy with suitable example. **8**

OR

c) Explain the similarity transformation with suitable example. **4**

d) Discuss the multiplication table of C_3V point group. **4**

e) Explain the great orthogonality theorem with suitable example. **4**

f) Define symmetry element. Discuss the different symmetry operation in H_2O molecule. **4**

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

b) Explain- **8**
i) Quadrupole interaction
ii) Magnetic hyperfine interaction in Mossbauer spectroscopy.

OR

c) Explain the mass spectral fragmentation in 1-hexene and benzaldehyde. **4**

d) Discuss the isotopic contribution of chloro and bromo compounds. **4**

e) Discuss the basic principle of Mossbauer spectroscopy. **4**

f) Explain the application of Mossbauer spectroscopy in structure determination. **4**

3. a) What is rigid rotor. Derive the equation for moment of inertia and rotational energy for rigid rotor. **8**

b) Discuss the principle and instrumentation in ESR Spectroscopy. **8**

OR

c) Explain the effect of isotopic substitution on transition frequencies in microwave spectroscopy. **4**

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

e) Explain the hyperfine coupling. **4**

f) Explain the ESR spectra of methyl radical and 1,4 - semi benzoquinone. **4**

4. a) Explain the vibrational rotational spectra of diatomic molecule. **8**

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

OR

c) Explain the P, Q, R branches. **4**

d) Explain the coherent anti-stokes Raman scattering. **4**

e) Distinguish the following compounds using IR spectroscopy. **4**

i) $CH_3-CH_2-NH_2$, $CH_3-CH_2-NH-CH_3$ and $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{|}}{N}-CH_3$

ii) CH_3CH_2OH and CH_3CH_2COOH

F) Explain- **4**

i) Force constant ii) Zero point energy

5. a) Define point group. Assign the point group to the following compounds. **2**

i) C_6H_6 ii) Bf_3

b) Define order of group. What is the order of group for C_2V and C_3V point group. **2**

c) n-nonane gives the fragmentation ions having $\frac{m}{2} = 126, 71, 57, 43$. Explain. **2**

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

e) Write a note on stark effect. **2**

f) Which of the following will show ESR spectrum and why? **2**

i) H ii) H_2

iii) Na^+ iv) NO

v) Cu^+ vi) Cu^{2+}

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

h) When will the Raman scattering occur. **2**

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