M.Sc. II (Chemistry) (C.B.C.S. and Old Pattern) Sem-III

PSCHT09 / MSc2331 - Spectroscopy

P. Pages : 2 **GUG/S/19/11331**

Time : Three Hours * 3 2 5 7 * Max. Marks : 80

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1. a) What are the rules for irreducible representation of group of great orthogonalitor theorem? Discuss the multiplication table for C_2v molecules? **8**

b) i) List the symmetry element of the following molecules and name the point group to which their belong CH_4, $PtCl_4$, C_6H_6 and $[Ni(CN)_4]^{2-}$. **8**

ii) Discuss the matrix representations of C_2v point group.

OR

c) Discuss the elements of symmetry with their schoenflies symbol. **4**

d) Discuss the character table for ammonia molecule. **4**

e) Write the application of character tables in selection rules of I.R. Raman spectroscopy. **4**

f) Discuss the various symmetry operations? **4**

2. a) Discuss the application of Mossbauer spectroscopy in determining the electronic structure and molecular structure. **8**

b) Describe various methods of ion production in mass spectrometry. **8**

OR

c) How will you distinguish between - 1 - Butanol, 2 - Butanol, and 2 - methyl 2 - propanol on the basis of mass spectrum? **4**

d) The mass spectral pattern of pentanal shows the peaks having m/e ratio at 86, 57, 44, and 29. Explain these peaks in term of fragmentation pattern? **4**

e) Write the absorption isomer shift and quadrupole interaction in Mossbauer technique? **4**

f) Explain the experimental technique in Mossbauer spectroscopy. **4**

3. a) Discuss the ESR spectra of the following radicals – **8**

i) Methyl radical ii) Napthalene

iii) 1, 4 – semi benzoquinone iv) Hydrogen atom

b) i) Calculate the moment of inertia of the molecule and obtain r_{C-H} and r_{C-N} fromit. **8**

Rotational constant of HCN is $1.4782\,cm^{-1}$. H is substitution by D, DCN, its value is $1.2077\,cm^{-1}$ for C^{12} and N^{14} isotopes?

ii) What is stark effect? Discuss its utility for determination of dipole moment of molecules?

OR

c) Explain the hyperfine coupling and zero field splitting? **4**

d) Defined and explain the Kramer's degeneracy? **4**

e) Discuss the effect of isotopic substitution on transition frequencies. **4**

f) A micro wave spectra of HCl Shows – 21.18, 42.36, 63.54, 84.72 and 105.91 cm^{-1}. Calculate moment of Inertia and bond length in HCl? **4**

4. a) i) Explain fundamental vibrational frequencies and zero point energy in IR spectroscopy. **8**

ii) Explain P, Q, R branches in IR spectroscopy.

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

OR

c) Discuss rotational Raman spectra for symmetric top molecule. **4**

d) How would you distinguish the following pair of compounds by I. R. spectra. **4**

i) CH_3-CH_2-OH and $C_6H_5-CH_2-OH$

ii) $CH_3-CH_2-NH_2$ and $C_6H_5-CONH_2$

e) Discuss coherent antistokes Raman spectroscopy. **4**

f) Discuss Morse potential energy diagram for an unharmonic oscillator. **4**

5. a) Define order of groups. Give order of Group in C_2v and C_3v point group. **2**

b) Give only classification of molecules on the basis of moment of Inertia with example. **2**

c) Which of the following molecules have centre of symmetry **2**
CH_4, CO_2, PF_5, SO_2, CH_2Cl_2 .

d) Find the vibrational degrees of freedom. **2**

i) CS_2 ii) H_2O

iii) C_6H_6 iv) ClF_3

e) Write a note on source in mossbauer spectroscopy. **2**

f) Draw the wellabled diagram of ESR spectrometer. **2**

g) Write a note on Nitrogen rule. **2**

h) Defined the Rayleigh Scattering with example? **2**

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