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

PSCHT09 - Spectroscopy Paper-IX

P. Pages : 2 **GUG/W/22/11331**

Time : Three Hours * 2 0 5 1 * Max. Marks : 80

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1. a) Derive the character table for C_2v point group using great Orthogonality theorem. **8**

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

OR

c) Discuss the classes of symmetry operation in C_3v point group **4**

d) Explain the vibrational modes for H_2O molecule using group theory. **4**

e) Derive the multiplication table for NH_3. **4**

f) Explain reducible and irreducible representations. **4**

2. a) Discuss the different types of fission processed in mass spectrometry. **8**

b) Discuss the application of Mossbauer spectroscopy with respect to **8**
i) Electronic structure ii) Surface studies

OR

c) Discuss the fast atom bombardment method for ion production in mass spectrometry. **4**

d) The mass spectrum of ethylbenzene shows peaks at m/e values 106, 105, 91, 65. Explain predict the base peak. **4**

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

f) Explain the following term in Mossbauer spectroscopy **4**
i) Isomer shift ii) Absorber

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

i) Effect of substitution on transition frequencies.

ii) Stark effect.

b) Explain the following in ESR Spectroscopy. **8**

i) Zero field splitting ii) Kramer's degeneracy

OR

c) Explain the classification of molecules on the basis of moment of inertia. **4**

d) Discuss the diatomic molecule as a non-rigid rotor. **4**

e) Explain the ESR spectra of methyl and 1, 4-semibenzoquinone radical. **4**

f) How does the microwave spectra differ from IR spectra? **4**

4. a) Explain the Morse potential energy function of an anharmonic oscillator. **8**

b) Explain application of Raman spectroscopy for the study of active sites of metalloproteins. **8**

OR

c) Distinguish between following pair of compounds using IR spectroscopy. **4**
i) Ethyl benzene and O-xylene
ii) Acetophenone and Benzyl alcohol

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

e) Discuss the rotational Raman spectra of a diatomic molecule. **4**

f) How would you distinguish between the following pairs on the basis of IR spectroscopy. **4**
i) Fundamental vibration and overtones
ii) Inter and intramolecular hydrogen bonding

5. a) Give the mathematic statement of great orthogonality theorem with the meanings of each symbol. **2**

b) Assign the point group. **2**
i) H_2 ii) HCl
iii) PCl_5 iv) $[Ni(CN)_4]^{2-}$

c) Write a short note on N-rule. **2**

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

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

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

g) How will you differentiate cis and trans isomer with the help of IR spectroscopy. **2**

h) What are the factors affecting the Raman peak intensities? **2**

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