PG – 185

IV Semester M.Sc. Examination, June 2017
(CBCS Scheme)
CHEMISTRY
C-404 : Spectroscopy – III
(Common to IC / AC / PC)

Time : 3 Hours Max. Marks : 70

***Instruction** : Answer Question No. **1** and **any five** of the **remaining**.*

1. Answer **any ten** of the following : **(10×2=20)**

a) What are isotropic and anisotropic coupling constants ?

b) Assign the structure of Cl_2O molecule. It shows three intense bands at 688 cm^{-1}, 320 cm^{-1} and 969 cm^{-1} in IR spectrum.

c) Using solid state NMR, how do you characterize the structure of PCl_5.

d) Define "Magic Angle Spinning" and list its advantages.

e) Calculate the ESR frequency for an unpaired electron in a field of 0.5T.

f) From ^{19}F NMR, predict the possible structure of BrF_5.

g) Explain the terms nuclear electric quadrupole moment and electric field gradient.

h) A Mössbauer nucleus of mass 2 $\times 10^{-25}$ kg emits γ- ray of wavelength 0.2 nm. Calculate the recoil velocity. ($h = 6.626 \times 10^{-34}$ JS).

i) Br_2 shows NQR and not F_2. Why ?

j) What is Frozen Orbital approximation ?

k) Mention any two uses of EELS.

l) How many peaks would result in the Auger Electron Spectrum of

i) Hydrogen

ii) Carbon

iii) Sodium ?

2. a) Explain hyper Raman phenomenon using relevant equation. Sketch the transitions involved and differentiate them into hyper-stokes and hyper-antistokes lines.

   b) How does a photoacoustic signal arise ? Using a block diagram explain the processes involved in photoacoustic effect. **(6+4=10)**

3. a) Define Linkage isomerism. Using suitable example, explain the importance of IR spectroscopy to characterize any one of the linkage isomer.

   b) List the various possibilities of carbonate coordination mode with metal and the corresponding changes that occur in IR. **(5+5=10)**

4. a) Define isomer shift and establish its relationship with S-electron density.

   b) Outline the effect of an external magnetic field on the NQR spectrum. **(6+4=10)**

5. a) Predict and explain ^{31}P NMR spectrum of $[Rh(Ph_3P)_3]^+ClO_4^-$ using ^{103}Rh ^{31}P coupling.

   b) Draw ^{31}P NMR spectra for α - and β - isomers of P_4S_4.

   c) Sketch and explain ^{11}B NMR spectrum of diborane. **(4+3+3=10)**

6. a) Give the theory and experimental details of inverse Raman process.

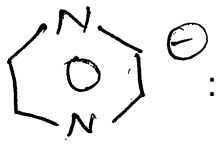
   b) List the applications of Resonance Raman spectroscopy. **(5+5=10)**

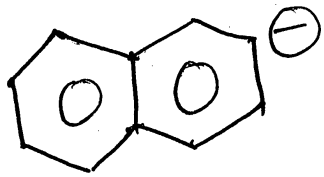
7. a) How are XANEs and EXAFs different from each other ? Elaborate on the principle underlying EXAFs technique.

   b) Explain quadrupolar interaction in Mössbauer spectroscopy with suitable example. Comment on the relative magnitudes of quadrupolar splitting in tetrahedral and square planar $SnCl_4$. **(5+5=10)**

8. a) Explain ENDOR and ELDOR techniques.

b) Draw EPR spectra for :

i)  : Pyrazine anion radical

ii)  : Napthalene anion radical

c) Determine g values of Ni^{2+} complex at magnetic field of $B_{\perp}$ 300.2 and B_{11} 255.1 MT (Reference DPPH at 328.63 MT). **(4+3+3=10)**