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2. Answer *any five* questions :  $2\frac{1}{2} \times 5$
- What do you mean by ORD ?
  - Discuss the nature of CD spectra of (-) Menthone in different solvents.
  - How we can isolate different isomers of tris(s-alaninato) cobalt(III) complex ?
  - Considering one specific example explain how position of a functional group of a molecule can be determined using CD.
  - What is LASER Raman spectroscopy ?
  - What are the advantages of Raman spectroscopy over Infrared spectroscopy ?
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Ex/M.Sc./CH/3/U-I-3121/13/2017

**M. Sc. CHEMISTRY EXAMINATION, 2017**

( 3rd Semester )

**INORGANIC CHEMISTRY SPECIAL**

**PAPER - XII - I**

Time : Two hours

Full Marks : 50

( 25 marks for each unit )

Use a separate answerscript for each group.

**UNIT - I - 3121 - a**

- Starting from Bloch equation derive the required relation between FID signal and  $T_1$  that can be applied in determining longitudinal relaxation time ( $T_1$ ). Describe in detail the Inversion Recovery (IR) method. 2+2
- How could you identify all the possible isomers of the compound  $\text{SnF}_4(\text{base})_2$  from their NMR spectra ?
  - Describe in detail the  $^{19}\text{F}$  NMR spectrum of  $\text{XeF}_4$ . 3+2
- Explain why  $J_{^{13}\text{C}-\text{H}}$  coupling constants of  $-\text{CH}_2-$  moiety in  $(\text{C}_6\text{H}_5)_2\text{CH}_2$  and  $(\text{CH}_3)_2\text{CH}_2$  differ from their corresponding carbonium ions. 2
- Comment on *any one* of the followings :
  - $^{19}\text{F}$  NMR of  $\text{HPF}_2$ .
  - $^{31}\text{P}$  NMR of  $\text{P}_4\text{S}_3$ . 1  $\frac{1}{2}$

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## UNIT - I - 3121b

5. "While  $\text{PFCl}_4$  retains its molecular symmetry in crystalline state  $\text{PPhCl}_4$  does not." Explain on the basis of NQR spectra.  $2\frac{1}{2}$

6. Complexes of composition  $\text{FeX}_2(\text{pyridine})_2$ , may be monomeric with four coordination or polymeric with six coordination in case of Fe. From the data given below for  $\text{X} = \text{Cl}$  and  $\text{I}$ , giving proper reason, deduce which one is polymeric.

Complex	IS/ $\text{mms}^{-1}$	QS/ $\text{mms}^{-1}$	
$\text{FeCl}_2(\text{Py})_2$	1.21	1.25	
$\text{FeI}_2(\text{py})_2$	0.86	1.33	3

7. Explain why the complex  $[\text{Co}(\text{NH}_3)_6]^{3+}$  shows NQR resonance for  $^{14}\text{N}$  but not for  $^{59}\text{Co}$ . While both isotopes have  $I \geq 1$ . 2

8. Deduce the required relation between quadrupole coupling constant and radiofrequency applied to observe NQR spectrum of  $\text{CH}_3\text{D}$  molecule. 4

9. Why Mössbauer spectrum of  $^{57}\text{Fe}$  often appears as doublet? 1

## UNIT - 3122

Answer the following questions

1. a) What makes a molecule Raman active? Using classical theory, explain the occurrence of Stokes and anti-stokes Raman scattering.
- b) The equilibrium vibration frequency of the iodine molecule ( $\text{I}_2$ ) is  $215 \text{ cm}^{-1}$ , and the anharmonicity constant ( $x$ ) is 0.003; what, at 300K, is the intensity of the 'hot band' ( $v = 1 \rightarrow v = 2$  transition) relative to that of the fundamental ( $v = 0 \rightarrow v = 1$ )?
- c) How will you prove the occurrence of linkage isomerism in  $[\text{Ru}(\text{dmsO})_6]^{2+}$  ( $\text{dmsO} = \text{dimethylsulfoxide}$ ) with the help of IR spectroscopy?
- d) Taking  $\nu_{\text{CO}}$  as a probe, how will you monitor the oxidative addition reaction in Vaska compound?
- e) The symmetrical stretching mode of  $\text{CO}_2$  is Infrared inactive but Raman active. Explain.
- f) Justify the infrared stretching frequencies observed for the following isoelectronic species :
 

$[\text{Mo}(\text{CO})_6]^+$	: 2090 $\text{cm}^{-1}$	
$[\text{Cr}(\text{CO})_6]$	: 2000 $\text{cm}^{-1}$	
$[\text{V}(\text{CO})_6]^-$	: 1858 $\text{cm}^{-1}$	$[3+2+2+2+\frac{1}{2}+2]$