

2021

Time :As in Programme

Full Marks : 50

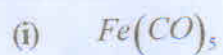
The figures in the right-hand margin indicate marks.

Answer **all** questions.

1. (a) Determine point group and normal mode of vibration in following molecules. 7
- (i)  $ClF_3$
- (ii)  $AuCl_4^-$
- (iii)  $BFCl_2$
- (b) How do you represent the mode of bonding ethylenediamine and diketonate complex and how they are differentiated in IR spectra. 6
- (c) How RRS is used to study the active of myoglobin and hemoglobin. 4
- Or
- (a) Prove for  $NH_3$  6  
 $\Gamma_{vib} = 2A_1 + 2E$
- (b) Explain basic principle of Resonance Raman Spectra. 6
- (c) What do you mean by reductant coordinate? Where and when does the redundancy occur in molecules-explain. 5

2. (a) What is g value? calculate the g value of  $Ti^{3+}$ .  
Discuss the factors affecting g value.
- (b) Predict the ESR lines of following compounds. 6
- $NH_2$ .
  - $^{11}BH_3$
  - $K_3[Mo(CN)_8]$
- (c) calculate the frequencies of an unpaired electron in a magnetic field of strength 0.35T ( $g=2.0$ ) 3
- (d) Explain the ESR of Iron-Protein Complex. 2
- Or
- (a) Molecular formula of a compound is  $C_8H_6$ , NMR spectra of such compound shows a singlet at 2.98  $\delta$  (1H) and multiplet at 7.4  $\delta$  (5H). Predict the structure of the compound. 5
- (b) A system of protons at a temperature of 25°C is placed in a magnetic field of 2 Tesla, what is the ratio of number of proton spins in the lower state to the number in the upper state? 5  
( $g_N=5.585, \mu_N=5.05 \times 10^{-27} \text{ JT}^{-1}$ )
- (c) What are contact shift reagents? What is the significance of using these reagents in NMR? 4
- (d) What is the use of  $^{195}\text{Pt}$  NMR? 3
3. (a) Discuss the principle of Mossbauer spectroscopy of  $^{57}\text{Fe}$  with the decay scheme of  $^{57}\text{Co} \rightarrow ^{57}\text{Fe}$  6

(b) Predict the Mossbauer spectra of following compounds and write their structure. 6



(c) Distinguish  $Sn^{2+}$  and  $Sn^{4+}$ ,  $Fe^{2+}$  and  $Fe^{3+}$  from isomeric shift. 4

Or

(a) Write notes on 10

(i) Isomeric shift

(ii) Quadrupole interaction

(b) What is the recoil energy of  $^{57}Fe$  nucleus if energy of the emitted  $\gamma$ -rays from the first excited state is 14.4KeV? 3

(c) The half life of the first excited state of  $^{57}Fe$  is  $1.5 \times 10^{-7}S$ . What is the line width of the resonance line?

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