

III-S-(M.Sc.-Chem)-CBCS-505-
(AS)R&B

2019

Time : As in Programme

Full Marks : 50

Answer **all** questions. The figures in the right-hand margin indicate marks.

1. (a) How many normal modes of vibration are expected for the following molecules from symmetry consideration? 6
- (i) H_2S
- (ii) trans - N_2F_2
- (iii) NDH_2
- (b) How do you identify spurious mode and missing mode of vibration? Explain with suitable example. 4

OR

BBS_64_(3)

(Turn Over)

(2)

- (a) Prove for water $\Gamma_{\text{vib}} = 2A_1 + B_2$ 4
- (b) Explain the mode of bonding of ambidentate ligands. 2
- (c) Explain Resonance Raman Spectra (RRS). Why the intensity of RRS is much higher than normal Raman Scattering. 4
2. (a) Write the basic principle of ESR. Why ESR is observed in microwave region? 6
- (b) A NMR spectrophotometer operating at 60 MHz frequency gives proton spectrum at a field of 1.40T. At what field would be ^{11}B spectra observed at 60 MHz (g_N of $^{11}\text{B} = 1.792$)? 4

OR

- (a) How ESR spectra is useful to elucidate the structure of a given complex : 2
 $(\text{NH}_3)_5\text{Co} - \text{o} - \text{o} - \text{Co}(\text{NH}_3)_5$
- (b) Calculate g-value of Fe^{3+} . 2
- (c) What is the frequency of radiation for resonance of free electron in a magnetic field of 0.3T? 2
- (d) Suggest a structure of the compound of molecular formula C_9H_{12} showing signals at 7.1, 2.2, 1.5 and 0.9 δ ppm. 4

(3)

3. (a) Explain the Mossbauer spectra of ^{119}Sn . 2
- (b) What is Doppler shift, if v-ray frequency of ^{119}Sn is $5.76 \times 10^{18}\text{Hz}$ and recoil velocity is 64.36 m sec^{-1} . 4
- (c) Why isomeric shift in some cases are positive and in some cases are negative? 2
- (d) Why $[\text{Fe}(\text{CN})_6]^{4-}$ shows one peak in Mossbauer spectra where as $[\text{Fe}(\text{CN})_5\text{NO}]$ shows two peaks. 2

OR

- (a) Write two applications of Mossbauer spectra. 4
- (b) What are the characteristics of Mossbauer nuclei? 2
- (c) Predict the Mossbauer spectra of following molecules and draw their spectra : 4
- (i) FeCl_3
- (ii) $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
- (iii) $\text{Fe}[\text{Fe}^{\text{III}}(\text{CN})_6]$
- (iv) $\text{K}_4[\text{Fe}(\text{CN})_6] \cdot 3\text{H}_2\text{O}$