2023
M.Sc.
Third Semester
CORE – 09
CHEMISTRY
Course Code: MCHC 3.11
(Inorganic Chemistry - III)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

Answer five questions, taking one from each unit.

UNIT–I

1. (a) Explain with examples showing that complexes involving bridging sulphato group exhibits more bands. 6
   (b) NH_3 stretching frequencies of complexes are lower than those of the free NH_3 molecule. Comment. 5
   (c) Mention the M–OH bending mode of $[Sn(OH)_6]^{2-}$ complex ion. 3

2. (a) Show with an example that CN^- stretching frequencies gets shifted to a higher value on coordination. 5
   (b) What are the different types of vibration exhibited by aquo complexes? Explain with examples. 5
   (c) Explain the positive shifts and negative shifts of thiocyanato complexes. 4

UNIT–II

3. (a) Explain the principle of ESR spectroscopy. 4
   (b) How many ESR hyperfine lines are present in the following complexes? $3\times2=6$

   (i) $\left[Cu\left(H_2O\right)_6\right]^{2+}$

   (ii) trans-$\left[Cr\left(H_2O\right)_4\left(NH_3\right)_2\right]^{2+}$

   [Given, $Cu\left(I=3/2\right), Cr\left(I=5/2\right), N\left(I=1\right), H\left(I=1/2\right)$]

(c) State and explain Drago's rule by taking an example. 2+2=4

4. (a) Explain the principle of NMR spectroscopy. 4

(b) Calculate ^{19}F NMR signals found in the following. 3×2=6

(i) SF_4

(ii) ClF_3

(iii) ClF_5

[Given, F(I=1/2)]

(c) Calculate fine lines and hyperfine lines of Mn^{2+} (HS) octahedral. [Given, Mn(I=5/2)] 4

UNIT–III

5. (a) Explain the basic principles of mass spectrometry. 4

(b) Discuss how to determined the molecular formula and isotope peaks by using mass spectroscopy. 6

(c) Write any four applications of ESI. 4

6. (a) What is meant by base peak? Explain the types of ions produced in mass spectrometer with suitable examples. 1+4=5

(b) Explain nitrogen rule. 4

(c) Discuss the working principles of MALDIMS. 5

UNIT–IV

7. (a) Give an account on isomer shift and its interpretation. 5

(b) Explain the quadrupole interaction of Mossbauer spectroscopy by taking Fe-57 as an example. 5

(c) How would you obtain the Mossbauer spectrum? Explain. 4

8. (a) Discuss the principle of Mossbauer spectroscopy. 5

(b) Discuss the effect of magnetic field on Mossbauer spectra. 5

(c) Explain the Mossbauer spectroscopy applications in: 2×2=4

(i) Chemical shift and bond nature.

(ii) Biological systems.

UNIT–V

9. (a) Write notes on lattice planes and indices. 4
   (b) Draw the stereographic projection of the point group 422, 4/m, 32 and mm2. 4
   (c) Explain the symmetry elements present in the space group triclinic $P\bar{1}$ by giving the necessary diagrams. 6

10. (a) Give an account on the d-spacing formulae and systematically absent reflections from the X-ray diffraction of crystals. 2+2=4
    (b) Draw the diagrams of the following screw axes $2_1, 3_1$ and 3_2 and explain the different symbols present in it. $2\times3=6$
    (c) Differentiate between point groups and space groups. 4
