2021
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 <u>five</u> questions, taking <u>one</u> from each unit.

UNIT–I

1. (a) What is infrared spectroscopy? NH_3 stretching frequencies of the complexes are lower than those of the free NH_3 molecule. Give reasons.   2+5=7
   (b) How will we know whether SCN^- is coordinated through sulphur or nitrogen?   3½
   (c) CN^- stretching frequencies get shifted to higher value on coordination. Why?   3½

2. (a) Discuss the infrared structural studies of the aquo and hydroxo complexes.   4
   (b) How will you differentiate free sulphato ion and unidentate complex from their IR spectrum? Illustrate with examples.   6
   (c) Write the application of Raman spectroscopy.   4

UNIT–II

3. (a) What is the principal of EPR spectroscopy?   3
   (b) Calculate the number of NMR lines in the following   2×4=8
      (i) ClF_3
      (ii) BrF_3
      (iii) P_4S_3
      (iv) SF_4
   (c) Calculate the number of lines in NMR spectrum of PF_5 at very low temperature.   3

4. (a) What is the principle of NMR spectroscopy? 3
   (b) Calculate the number of lines in EPR spectroscopy of the following

   (i) $\overset{\bullet}{C}H_2D$ (D,I=1)

   (ii) $\overset{\bullet}{N}H_3$ (N,I=1)

   (ii) $\overset{\bullet}{C}D_3$ (D,I=1) 2×3=6

   (c) State and explain Drago's rule with examples. 2+3=5

UNIT–III

5. (a) Discuss the basic principles of mass spectroscopy with
       instrumentation. 3+3=6
   (b) Write note on any two types of fragmentation. 2+2=4
   (c) Briefly explain chemical ionisation. Give its advantages. 3+1=4

6. (a) Discuss the application of MALDIMS in biomolecules. 5
   (b) Write note on isotope abundance. 4
   (c) Draw the bar-graph representation of the mass-spectrum of
       n-butane and also give its fragmentation. 3+2=5

UNIT–IV

7. (a) Give an account on isomer shift and its interpretation. 5
   (b) Discuss the effect of magnetic field on Mossbauer spectra. 5
   (c) Write short note on the application of Mossbauer spectroscopy to
       metal carbonyls. 4

8. (a) Write short note on the principle of Mossbauer spectroscopy. 4
   (b) Explain the quadrupole interaction of MS by taking Fe-57 as an
       example. 5
   (c) Discuss the application of MS to iron compounds. 5

UNIT–V

9. (a) Give an account on the *d*-spacing formulae and systemetically absent reflections from X-ray diffraction of crystals. 2+2=4

   (b) Discuss the relationship between the point symmetry and structure of molecules by taking methylene dichloride (CH_2Cl_2) molecule as an example. 6

   (c) Explain the screw axes and the different types of glide planes that occur in the crystals. 4

10. (a) Discuss the interpretation of Bragg's equation $2d.\sin\theta = n\lambda$ 4

    (b) Give an account on the orthorhombic point group 222 by drawing the stereographic projection. 5

    (c) Explain the crystal growing data collection with the help of diagrams. 5

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