[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5040 **L**

Unique Paper Code : 2174001203

Name of the Paper : GE: Coordination and Organometallic Compounds

Name of the Course : **B.Sc. (H)**

Semester : VIII

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **4** questions in all. **All** the questions carry equal marks.
3. The questions should be numbered in accordance to the number in the question paper.
4. Calculators and log tables may be used.

1. **(a)** Show the splitting of d- orbitals in a tetrahedral ligand field. What can you say about the magnitude of crystal field splitting in a tetrahedral field as compared to that in an octahedral field? Why low-spin tetrahedral complexes are not known?

(b) Give the IUPAC names of the following:

(i) $K_3[V(S_2O_3)_2]$
(ii) $[Cr(NH_3)_6][Cu(CN)_5]$
(iii) $[Ni(en)_2(NH_2)_2]$
(iv) $[Cr(H_2O)Cl_2]Cl$
(v) $[Co(C_2O_4)(en)_2]^+$

(c) Draw the structure of methyl lithium. What are the coordination numbers of Li and C in the tetramer?

2. **(a)** For Cr^{2+} octahedral complexes in strong and weak field, determine the following:

(i) configuration in terms of $t_{2g}^m e_g^n$
(ii) number of unpaired electrons
(iii) crystal field stabilization energy. Show the distribution of electrons in respective d- orbitals in the crystal field splitting diagram.

(b) Give any two methods of preparation of metal carbonyls.

(c) What is meant by π acidity? Is CO a stronger π acid ligand than NO^+or not? Justify your choice.

(6, 5, 4)

P.T.O.

3. **(a)** What are inner and outer orbital complexes? Give two examples of each.
   (b) Draw the structure of Zeise's salt. Discuss about its bonding. What are the similarities and differences of Zeise's salt with carbonyl compounds.
   (c) The magnetic moment of $[MnBr_4]^-$ is 5.9 B.M. What is the geometry of this complex ion? Justify your answer. (6, 5, 4)

4. **(a)** Draw the MO diagram of CO and explain the following:
   (i) CO acts as an electron pair donor and acceptor through carbon and not through oxygen and formation of both sigma and π bond involve carbon.
   (ii) CO has negligible donor properties to Lewis acids like BF_3 but binds to transition metals.
   (b) With NH_3, nickel forms octahedral complex whereas with CN^- ion, it forms square planar complex. Discuss on the basis of CFT.
   (c) Arrange the following in increasing order of IR stretching frequency. Justify your answer. $[Ni(CO)_3PPh_3]$, $[Ni(CO)_3PMe_3]$ and $[Ni(CO)_3PF_3]$. (6, 5, 4)

5. **(a)** Using VBT derive the structures of; $Cr(CO)_6$ and $Mn_2(CO)_{10}$.
   (b) Define 18-electron rule. Show that $Fe_3(CO)_{12}$ obeys 18 electron rule.
   (c) Answer the following with reason. The value of Δ_o in $[CoI_6]^{3-}$ increase or decrease if:
   (i) Ligands I^- replaced by NO_2^- ligands
   (ii) Central metal ion Co^{3+} is replaced by Ir^{3+} (6, 5, 4)

6. **(a)** Differentiate between ionic and covalent sigma bonded organometallic compounds giving suitable example.
   (b) Define Jahn-teller theorem. explain how the d- orbital energy levels change in Cu^{2+} (d^9) ion when the regular octahedron distorts?
   (c) Write a short note on – Limitations of Crystal Field Theory. (6, 5, 4)