5. (a) Define Jahn-Teller theorem. Giving reason, explain in which case this effect would be observed :

$t_{2g}^{3}e_{g}^{1}$ or $t_{2g}^{6}e_{g}^{2}$

(b) Explain why crystal field splitting energy for octahedral complex is larger than square planar complex.

(c) $(Co(NH_3)_6]^{3+}$ is an inner orbital octahedral complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex. Explain. (5,5,5)

6. (a) Write the IUPAC names of following complexes :

(i) $[Ni(NH_3)_2(H_2O)(NO_2)]Br$

(ii) $[Pt(py)_4][PtCl_4]$

(iii) $[Co(en)_3]Cl_3$

(b) Name the type of isomerism in the following pairs of isomers and discuss a method to distinguish them :

(i) $[Co(NH_3)_6][Cr(NO_2)_6]$ and $[Cr(NH_3)_6][Co(NO_2)_6]$

(ii) $[RuCl(en)_2(H_2O)]Cl_2$ and $[RuCl_2(en)_2]Cl.H_2O$

(c) (i) The vanadium-carbon bond distance is longer in $V(CO)_6$ than in $[V(CO)_6]^-$. Give reason.

(ii) What is meant by the term 'hapticity'. Explain with suitable examples. (5,5,5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7016 **K**

Unique Paper Code : 2172581101

Name of the Paper : DSC – INORGANIC CHEMISTRY

Name of the Course : **B.Sc. (Prog.) in Applied Life Science with Agrochemicals and Pest Management**

Semester : I

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. **All** questions carry equal marks.
3. Attempt any **four** questions.

1. (a) The magnetic moment of $[Fe(H_2O)_6]^{3+}$ is 5.92 B.M. and that of $[Fe(CN)_6]^{3-}$ is 1.73 B.M. Explain on the basis of crystal field theory.

(b) Define the following terms :

(i) Ambidentate ligands

(ii) Crystal field stabilization energy (CFSE)

(c) Which of the following is not considered as an organometallic compound and why?

$(C_2H_5)Zn$, $B(OCH_3)_3$, NaCN, $Ni(CO)_4$ and CaC_2 (5,5,5)

2. (a) What is 18 electron rule? Using 18 electron rule as guide, predict which of the following compounds are stable

(i) $Fe_3(CO)_{12}$

(ii) $[Co(\eta^5\text{-}C_5H_5)(CO)_3]$.

(iii) $Mn(CO)_5Br$

(b) Arrange the following compounds in increasing order of IR stretching frequencies of C-O bond:

(i) $[Mn(CO)_6]^{2+}$, $[Cr(CO)_6]^{+}$, $[V(CO)_6]^{-}$

(ii) $[Fe(CO)_4]^{2-}$, $[Co(CO)_4]^{-}$, $[Ni(CO)_4]$

(c) Draw MO diagram of CO and explain why CO acts as an electron pair donor and acceptor through C and not O. (5,5,5)

3. (a) What are organometallic compounds? Giving appropriate examples, explain how will you classify organometallic compounds based on nature of metal-carbon bond present in it?

(b) What is zeise's salt? Discuss the bonding in zeise's salt on the basis of Dewar- Chatt-Duncanson model and IR studies. How is M-C bonding in zeise's salt different from that in metal carbonyl complexes?

(c) (i) Describe different factors which affects the magnitude of Δ_0.

(ii) Which of the following compounds have high CFSE and why? $[Cr(CN)_6]^{3-}$ or $[Cr(NH_3)_6]^{3+}$. (5,5,5)

4. (a) (i) Using the valence bond method, assign hybridization, geometry and predict the magnetic moment (in Bohr magnetons) for $[Cr(en)_3]^{2+}$ complex.

(ii) State two limitations of valance bond theory.

(b) Explain :

(i) Cu^{2+} ions are coloured and paramagnetic whereas Zn^{2+} ions are colourless and diamagnetic.

(ii) All tetrahedral complexes are high spin.

(c) Draw crystal field splitting diagram for $[CoCl_4]^{2-}$ and $[Fe(CN)_6]^{4-}$. Also calculate CFSE for both. (5,5,5)

P.T.O.