(3 Hours) [Total Marks : 75

N. B. : (1) All questions are **compulsory**.

(2) All questions carry **equal** marks.

(3) **Figures** to the **right** indicate **full** marks.

1. Attempt any **five** of the following :– 15

(a) Give three important features which distinguish Orgel diagram from Tanabe Sugano diagram.

(b) State Curie's law and Curie-Weiss law for temperature dependance of paramagnetism.

(c) Explain Racah Parameters.

(d) Total electron count in $[Ir_4(CO)_{12}]$ and $[Rh_6(CO)_{16}]$.

(e) Calculate heat of hydration for SO_4^{2-} and CO_3^{2-} using Latimer equation [Given radius of SO_4^{2-} is 244 pm and CO_3^{2-} is 164 pm]

(f) Role of iron bound protein in oxygen transport.

(g) Calculate μ_{eff}, magnetic moment using spin only formula for

(i) $[CrF_6]^{3-}$

(ii) $[Cr(CN)_6]^{2-}$

(iii) $[Ni\,Cl_4]^{2-}$

(h) Synthesis of β-keto acids using metal complexes.

2. (a) Explain fluxionality in (i) iron penta carbonyl (ii) phosphorus penta flouride. 5

OR

(a) Discuss the addition and substitution methods for the preparation of co-ordination compounds. 5

(b) Explain chirality with respect to tetrahedral and octahedral complexes. Give examples of six co-ordinated metal complexes. 5

OR

(b) Draw molecular energy level diagram for complexes with square planar geometry consider sigma (σ) bonding only. 5

(c) Explain trans effect. Using trans effect identify A, B, C, D 5

(i) $[PtCl_4]^{2-} \xrightarrow{\quad NH_3 \quad} [A] \xrightarrow{\quad NH_3 \quad} [B]$

(ii) $[PtCl_4]^{2-} \xrightarrow{\quad NO_2 \quad} [C] \xrightarrow{\quad NH_3 \quad} [D]$

3. (a) Construct Orgel diagram for a complex having d^2 configuration in octahedral and tetrahedral field. State its various electronic transitions. On this basis deduce the electronic spectra of $[V(H_2O)_6]^{2+}$.   5

OR

(a) Explain the Guoy's method to determine the magnetic susceptibity of substances.   5

(b) Give the ground state term and first excited state term for the metal ions with d^2, d^3 and d^5 configuration. Show the splitting of ground state terms with respect to their energies in octahedral field.   5

OR

(b) Explain quenching of the orbital moments using spin only magnetic calculate μ_{eff} for Co (II) complexes in weak and strong field ligands   5

(c) If Racah parameter B for Ni^{2+} free ion is 1030 cm^{-1}, calculate Nepheleuxatic ration β for the complex, [Given : The three absorphon bands occur at   5
$\upsilon_1 = 10750$ cm^{-1}, $\upsilon_2 = 17500$ cm^{-1} and $\upsilon_3 = 28000$ cm^{-1}.

4. (a) Explain the molecular rearrangement reactions in metal complexes with suitable examples.   5

OR

(a) What is meant by racemisation reaction? Explain intermolecular mechanism of racemisation with suitable examles of tris chelate complexes.   5

(b) What is an acid-base predominance diagram? Construct acid base predominance diagram and explain it with the help of one cationic species.   5

OR

(b) (i) How is Drago-Wayland equation used to predict the strength of acid-base reactions.   5
     (ii) State characteristic features of Pourbaix diagram.

(c) Give the relationship between free energy change and overall formation constant. Explain spectrophotometric method for the determination of stability constant of metal complexes.   5

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5. (a) What are biomolecules? How are they classified? Give an example of   5
        each.

OR

    (a) Explain the phenomenon of photosynthesis with schematic   5
        representation.

    (b) Give the synthesis and various applications of organo palladium   5
        compounds.

OR

    (b) With the help of suitable diagram explain the terms :   5

            (i) flourescence
            (ii) phosphorescence
            (iii) intersystem crossing

    (c) What is meant by isolobal analogy? Find the organic fragments isolobal   5
        with each of the following :

            (i) $[Ni(\eta^5-C_5H_5)]$
            (ii) $[Fe(CO)_2(PPh_3)]^{-1}$
            (iii) $[Cr(CO)_2(\eta^6-C_6H_6)]$
            (iv) $[Mn(CO)_5]$

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