CLASS: IMSc/MSc   SEMESTER : VIII/II
BRANCH: CHEMISTRY   SESSION : SP/2023

SUBJECT: CH408 ADVANCED INORGANIC CHEMISTRY

TIME: 3 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. **The question paper contains 5 questions each of 10 marks and total 50 marks.**
2. **Attempt all questions.**
3. **The missing data, if any, may be assumed suitably.**
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. **Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

			CO	BL
Q.1(a)	For a multi electronic system, graphically represent the mutual inclination of electron orbit and resultant vectors. Calculate the spin-orbit coupling constant of Ni^{2+} in $Ni(CO)_4$, if the spin-orbit coupling constant of Ni^{2+} is 630cm^{-1}.	[5]	1	1
Q.1(b)	Prove that the energy difference between successive *J* levels is the product of spin orbit coupling constant and the higher *J* value.	[5]	1	2
Q.2(a)	Calculate the % of low spin Fe(III) in tris-dimethyl dithio carbamato Fe(III) ion from the following data: μ_{eff} = 4.3 at room temperature.	[4]	2	2
Q.2(b)	tetra phenyl porphyrin Fe(III) cation is separately reacted with H_2O, ClO_4^- and CN^-.Predict the magnetic moment of all the products and discuss the magneto structural corelation.	[6]	2	2
Q.3(a)	Compare the magnetic moment of the following: $[(NH_3)_5Cr-O-Cr(NH_3)_5]Br_4$ and $[(NH_3)_5Cr-OH-Cr(NH_3)_5]Br_5$.	[2]	3	2
Q.3(b)	For the molecules of formula: $[Cu(RCOO)_2H_2O]_2$, discuss the trend in magnetic moment for R = CH_3, *t*-Bu, Cl_2CH, CF_3	[2]	3	2
Q.3(c)	Derive the expression of magnetic moment for systems with band width larger than thermal energy.	[6]	3	1
Q.4(a)	Consider the following molecules. Calculate the total valance electron count (TVE), and polyhedral electron count (PEC) and assign each one as *closo*, *nido*, *arachno* or *hypo*. 6 $Ru_5C(CO)_{16}$ $[Fe_4(CO)_{12}C]^{2-}$ $B_9H_{14}^-$ $C_2B_4H_6$ $[Sn_9]^{4-}$ $[Bi_4]^{2-}$	[6]	4	2
Q.4(b)	Derive the all-possible STYX code for B_4H_{10}. Also, indicate the possible acceptable STYX codes.	[4]	4	2
Q.5(a)	Predict the total valance electron count (TVE) and the total number of atoms (n) upon condensation of polyhedral units (according to Mingo's rule) for the following and also, draw the structure of the initial and final Polyhedral *Two* Tetrahedral units via face-sharing *One*-Tetrahedral unit and *one*-closed triangle via edge-sharing *One*-Octahedral and *two*-tetrahedral units via face-sharing	[6]	5	2
Q.5(b)	Write the reactions for the following transformation i) Hydrolysis of *cyclic-tetra*-phosphonitrilic chloride Ammonolysis of S_2Cl_2 ii) Ammonolysis of S_2Cl_2	[2]	5	5
Q.5(c)	Imide of Sulphur is obtained by replacing one or more sulphur (S)-atom in sulphur-S_8 ring by imide group (NH). Then write the structure of i) $S_4(NH)_4$ and ii) 1,3,6- $S_5(NH)_3$	[2]	5	1