BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO-24)

CLASS: MSc/IMSc **SEMESTER: Ist**
BRANCH: CHEMISTRY **SESSION: MO/2024**

SUBJECT: CH401 BASIC INORGANIC CHEMISTRY

TIME: 03 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*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	According to VBT, write down the expression for the Coulomb's Integral for the formation of H2 molecule from H atoms.	[2]	CO1	2
Q.1(b)	Mention the different corrections incorporated into the trivial solutions of the energy expression of an one electron system e.g., H_2^+ according to LCAO-MO treatment.	[4]	CO1	2
Q.1(c)	Mathematically represent the formation of molecular orbital considering the hybridization of the atomic orbitals and draw the molecular orbital diagram for homo diatomic molecule.	[4]	CO1	3
Q.2(a)	For a heteroleptic complex, with example discuss the rule of average environment. Find the CFSE for MA_nB_{6-n}, when ΔMA_6 = 2000 cm^{-1} and Δ MB_6 = 3000 cm^{-1}.	[5]	CO2	2
Q.2(b)	What is trans effect? Discuss various theories of trans effect.	[5]	CO2	1
Q.3(a)	Discuss the mechanism involved in the base hydrolysis of octahedral Co(III) complexes. Which of the following will have higher rate of base hydrolysis: $[Co(NH_3)_5Cl]Cl_2$, $[Co(Py)_5Cl]Cl_2$?	[5]	CO3	2
Q.3(b)	With example discuss the Eigen-Wilkinson mechanism for the ligand substitution reaction for $[Ni(H_2O)_6]^{2+}$. Predict the rate on changing the entering ligand as F^-, HF, H_2O, NH_3, en, SCN^- in this reaction.	[5]	CO3	3
Q.4(a)	Predict the double structured electronic spectrum of $TiCl_3$. 6 H_2O.	[4]	CO4	1
Q.4(b)	For the octahedral complexes of Ni^{+2} with glycine, ammonia, ethylenediamine, bipyridyl and phenanthroline how the intensity of spin allowed and spin forbidden transition vary. In this context highlight the phenomenon of Intensity Stealing.	[4]	CO4	2
Q.4(c)	Identify the Symmetry Point Group of the following: $Co(NH_3)_5Cl$	[2]	CO4	2
Q.5(a)	In the electronic spectra of $[Cr(H_2O)_6]^{2+}$, along with the sharp peak at 14,000 cm^{-1}. one shoulder is obtained at 15,000 cm^{-1} – Interpret the spectrum with the electronic transition in ORGEL Diagram.	[5]	CO5	3
Q.5(b)	cis Co(en)2F2 shows two peaks, whereas trans Co(en)2F2 shows three peaks - Explain	[5]	CO5	2

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