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

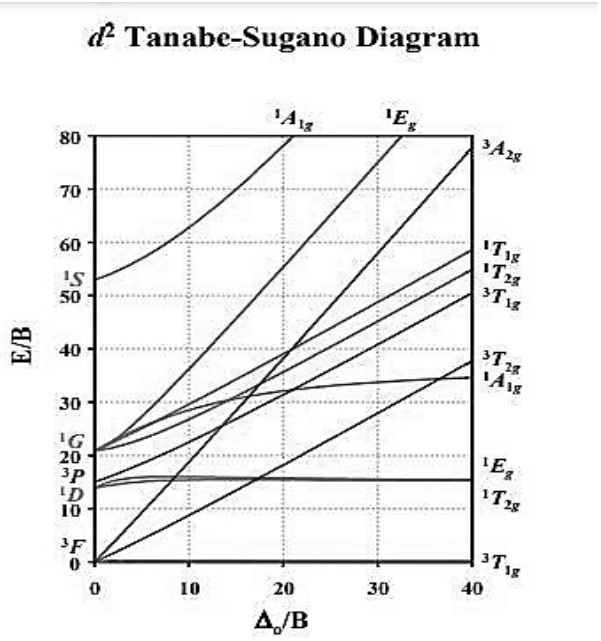
CLASS: IMSc/MSc/PRE-PHD **SEMESTER : VII/I**
BRANCH: CHEMISTRY **SESSION : MO/2025**

SUBJECT: CH401 BASIS 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)	Mention the modifications made for the improvement of poor agreement of binding energy of hydrogen molecule in the Valence Bonde Theory (VBT). Plot the binding energy against internuclear distance of hydrogen molecule in each case.	[5]	1	1
Q.1(b)	Draw the hybrid MO diagram of CO and explain the π acidic nature of the ligand.	[5]	1	2
Q.2(a)	Show the d orbital splitting pattern change for the transformation of $[Ni(CN)_4(H_2O)_2]^{2-}$ to $[Ni(CN)_4(H_2O)]^{2-}$ to $[Ni(CN)_4]^{2-}$. Also find the symmetry point group for all the three molecules.	[5]	2	2
Q.2(b)	In a redox process, number of microstates of a 1st row transition metal increases from 45 to 120. Write down the redox process	[5]	2	2
Q.3(a)	For the homonuclear electron transfer reaction: $[M^*(NH_3)_6]^{3+} + [M(NH_3)_6]^{2+} \rightarrow [M^*(NH_3)_6]^{2+} + [M(NH_3)_6]^{3+}$, rate of the reaction for M = Co is $1x10^{-6}$ $M^{-1}s^{-1}$ and for M= Ru rate is $8.2x10^2$ – Explain.	[3]	3	2
Q.3(b)	Discuss the theories of trans effect.	[3]	3	1
Q.3(c)	$[Co(NH_3)_5Cl]^{2+}$ undergoes base hydrolysis much faster than $[Co(py)_4Cl_2]^+$. In this context discuss the mechanism of base hydrolysis of octahedral complexes.	[4]	3	2
Q.4(a)	For centrosymmetric octahedral geometry, allowed vibronic transition is only $E^0_g \leftrightarrow E^1_u$ – Prove.	[5]	4	1
Q.4(b)	With example, discuss rule of average environment in coordination complex in terms of electronic spectroscopy.	[5]	4	2
Q.5(a)	Write short note on : Spectrochemical Series and Nephalaxulic Effect	[5]	5	1
Q.5(b)	For $[V(H_2O)_6]^{3+}$, two peaks are observed at 17,200 cm^{-1} and 25700 cm^{-1}, find B, Δ and the energy of 3rd peak from the following data of Tanabe Sugano diagram $v_1/B=25$, $v_2/B=37$, $v_1/B=52$ and $\Delta/10B= 2.7$	[5]	5	3



::::::21/11/2025::::::E