BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID-SEMESTER EXAMINATION SP/2025)

CLASS: INT. MSc **SEMESTER: VI**
BRANCH: CHEMISTRY **SESSION: SP/2025**

SUBJECT: CH313R1 INORGANIC CHEMISTRY-IV

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 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)	Arrange the stretching frequency of Carbon monoxide (ν_{CO}) of CO, $Cr(CO)_6$, $Cr(CO)_3(NH_3)_3$ and $Cr(CO)_3(PPh_3)_3$ in increasing order with proper explanation.	[2]	1	2
Q.1(b)	Consider the 18-electron rule as a guide and determine the unknown quantity in the following complexes. [3] i) $[(\eta^5-Cp)W(CO)_x]_2$ (has a W-W single bond) determine x. ii) $MnBr(CO)_n$ determine n. iii) $[(\eta^5-Cp)Mn(CO)_x]_2$ (has a Mn=Mn double bond) determine x.	[3]	1	3
Q.2(a)	Based on the Valance bond theory, explain the structure of $Co_2(CO)_8$ and $Ni(CO)_4$.	[2]	1	2
Q.2(b)	Calculate the total number of metal-metal bonds, bond per metal and predict the structure of (i) $Ru_3(CO)_{12}$ and (ii) $Co_4(CO)_{12}$ based on the 18-electron rule.	[3]	2	3
Q.3(a)	What is Collman's reagent? Discuss its synthesis and applications in organic synthesis.	[2]	2	1
Q.3(b)	Based on Molecular orbital theory explain: why CO binds a metal through its less electronegative carbon atom than its more electronegative oxygen. What makes it a good π-acceptor?	[3]	2	2
Q.4(a)	Draw energy profile diagram for exothermic and endothermic reaction.	[2]	4	2
Q.4(b)	Discuss the mechanism of electrostatic polarisation and pi bonding theory to explain the trans effect.	[3]	4	2
Q.5(a)	Discuss the mechanism to explain the Nucleophilic Substitution reaction in octahedral complexes.	[2]	4	2
Q.5(b)	Discuss the factors affecting stability of complexes.	[3]	4	3

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