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

CLASS: IMSc **SEMESTER : VI**
BRANCH: CHEMISTRY **SESSION: SP/2025**

SUBJECT: CH313R1 INORGANIC CHEMISTRY-IV

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)	Calculate the total number of metal-metal bonds present in a metal complex of $(\mu - Br)_2[Mn(CO)_4]_2$	[2]	1	2
Q.1(b)	What is oxidative decarbonylation?	[2]	1	1
Q.1(c)	What will be the hapticity of the cp-ring in the metal complex of $Fe(cp)(CO)_3Cl$ if it obeys the 18-electron rule?	[3]	1	3
Q.1(d)	Discuss the structure of Methyl-lithium and tri-alkyl aluminum dimer.	[3]	1	1
Q.2(a)	Why are alkenes bound to metal prone to nucleophilic attack rather than electrophilic attack?	[2]	2	2
Q.2(b)	Discuss three parameters to classify the alkene complex as Dewar-Chatt-Duncanson or metallacyclopropane.	[3]	2	1
Q.2(c)	What is ß-hydride elimination? Which of the following metal-alkene complexes is most unstable and why? a. $Ti(CH_2CH_3)_4$ b. $Ti(CH_2Ph)_4$ c. $Pb(CH_3)_4$ d. $W(CH=C(CH_3)_2)_6$	[5]	2	3
Q.3(a)	Compare the aromaticity of ferrocene with benzene. How does the metal d-orbital split in ferrocene?	[5]	3	2
Q.3(b)	Discuss catalytic cycles for Olefin polymerization using Ziegler-Natta catalyst.	[5]	3	2
Q.4(a)	Using Crystal Field Theory, explain why $[Cr(H_2O)_6]^{3+}$ is labile while $[Co(NH_3)_6]^{3+}$ is considered inert, despite both being octahedral d^3 and d^6 complexes, respectively. How do pairing energy and crystal field splitting energy influence substitution reactions	[5]	4	2
Q.4(b)	Explain the S_N1CB mechanism, and how does it differ from other nucleophilic substitution mechanisms? Explain the mechanistic steps involved, the role of the conjugate base and conditions that favor this pathway	[5]	4	3
Q.5(a)	Describe the mechanism of the Wacker process for the oxidation of ethylene to acetaldehyde. Discuss the role of palladium(II) chloride and copper(II) chloride in the catalytic cycle. How is the palladium catalyst regenerated?	[5]	5	1
Q.5(b)	Explain the structure, mode of action, and catalytic mechanism of Wilkinson's catalyst in the hydrogenation of alkenes.	[5]	5	3

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