

**2024/TDC (CBCS)/EVEN/SEM/
CHMHCC-601T/307**

TDC (CBCS) Even Semester Exam., 2024

CHEMISTRY

(6th Semester)

Course No. : CHMHCC-601T

**[Organometallic Chemistry
(Inorganic Chemistry)]**

Full Marks : 50

Pass Marks : 20

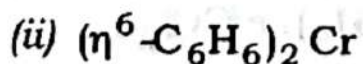
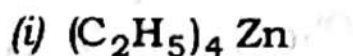
Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

1. Answer any two questions from the following : 2×2=4

(a) Define organometallic compounds. Identify the nature of metal-ligand bond in the following organometallic compounds : 1+1=2



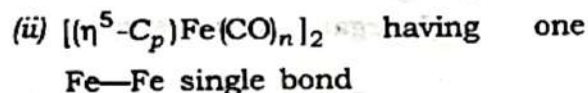
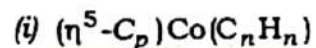
(2)

- (b) What is the hapticity of the ligand in the given complex? Mention the maximum hapticity possible with this ligand : $1+1=2$



- (c) Using $18e^-$ rule as guide, determine the values of n in the following complexes :

$$1+1=2$$



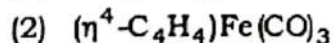
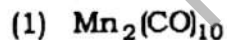
2. Answer any *one* question from the following : 6

- (a) (i) What is meant by π -acidity? 1

- (ii) Is CO a stronger π -acid ligand as compared to NO^+ ? Justify your answer. $\frac{1}{2}+\frac{1}{2}=1$

- (iii) What is synergic effect? How does it account for the formation of carbonyls with transition metals in low oxidation states? $1+3=4$

- (b) (i) Draw the structures of the following complexes following EAN rule : $1 \times 2 = 2$



(3)

- (ii) Why is direct nitration of ferrocene not possible? How can you get the nitro derivative of ferrocene? $1+1=2$

- (iii) Draw the structures of ferrocene in solid and gaseous states. 2

UNIT—II

3. Answer any *two* questions from the following : $2 \times 2 = 4$

- (a) Draw the structure of methyl lithium. What are the coordination numbers of Li and C in methyl lithium? $1+1=2$

- (b) Write the composition of Ziegler-Natta catalyst. Mention its use. $1+1=2$

- (c) Write the synthesis of the cobalt catalyst used in the hydroformylation reaction. 2

4. Answer any *one* question from the following : 6

- (a) (i) What is Grignard reagent? Why is diethylether an especially good solvent for the preparation of Grignard reagent? $1+2=3$

- (ii) What is Schlenk equilibrium? Explain. 2

- (iii) Write the limitations of Grignard reaction. 1

(4)

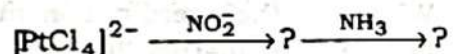
- (b) Both AlEt_3 and AlCl_3 dimerize but the nature of alkyl bridging and halide bridging in the dimers are different. Justify.

6

UNIT—III

5. Answer any two questions from the following : $2 \times 2 = 4$

- (a) Show the stereochemistry of substitution in the following reaction :



- (b) Define thermodynamic and kinetic stabilities of complexes.

- (c) Define electrophilic substitution reaction in octahedral complexes. Give a suitable example. $1+1=2$

6. Answer any one question from the following : 6

- (a) (i) What is *trans*-effect? Explain *trans*-effect in the light of electrostatic polarization theory. $1+3=4$
- (ii) What do you mean by aquation and anation reaction in octahedral complexes? Give suitable examples. 2

(5)

- (b) Discuss the mechanism of nucleophilic substitution reactions in octahedral complexes and also mention the stereochemistry of the intermediates. 6

UNIT—IV

7. Answer any two questions from the following : $2 \times 2 = 4$

- (a) Draw and explain the structure of Wilkinson catalyst.
- (b) Define oxidative addition reaction. Give example. $1+1=2$
- (c) Write the limitations of cobalt catalysts mediated hydroformylation reaction.

8. Answer any one question from the following : 6

- (a) (i) What is synthesis gas? Mention a few sources of synthesis gas. $1+1=2$
- (ii) Discuss the mechanistic pathway involved in the production of synthesis gas using metal carbonyl complexes. 4
- (b) (i) What is Fischer-Tropsch process? Mention the catalysts used in this process. $1+1=2$
- (ii) Explain the most plausible mechanism for this process. 4

(6)

UNIT—V

9. Answer any two questions from the following : $2 \times 2 = 4$

(a) Define common ion effect.

(b) Write the chemistry of removal of BO_3^{3-} from the solution during qualitative analysis of a salt mixture.

(c) What happens to the solubility of Ag_2CO_3 in water on addition of AgNO_3 ? Explain. $1+1=2$

10. Answer any one question from the following : 6

(a) (i) Explain how common ion effect helps in precipitation of Group-III hydroxides. 2

(ii) When 0.01 M HCl solution is added to a 0.01 M $\text{Pb}(\text{NO}_3)_2$ solution, will a precipitate of PbCl_2 be formed or not? Given, K_{sp} for $\text{PbCl}_2 = 1.6 \times 10^{-5}$. 3

(iii) Mention the group reagents used for analyzing the following cations : 1

(1) Zn^{2+}

(2) Mg^{2+}

(7)

(b) (i) Explain how a buffer solution resists change in pH. 3

(ii) (1) Write the difference between ionic product and solubility product. 1

(2) Discuss the cause of interference of some acid radicals in inorganic qualitative analysis. 2
