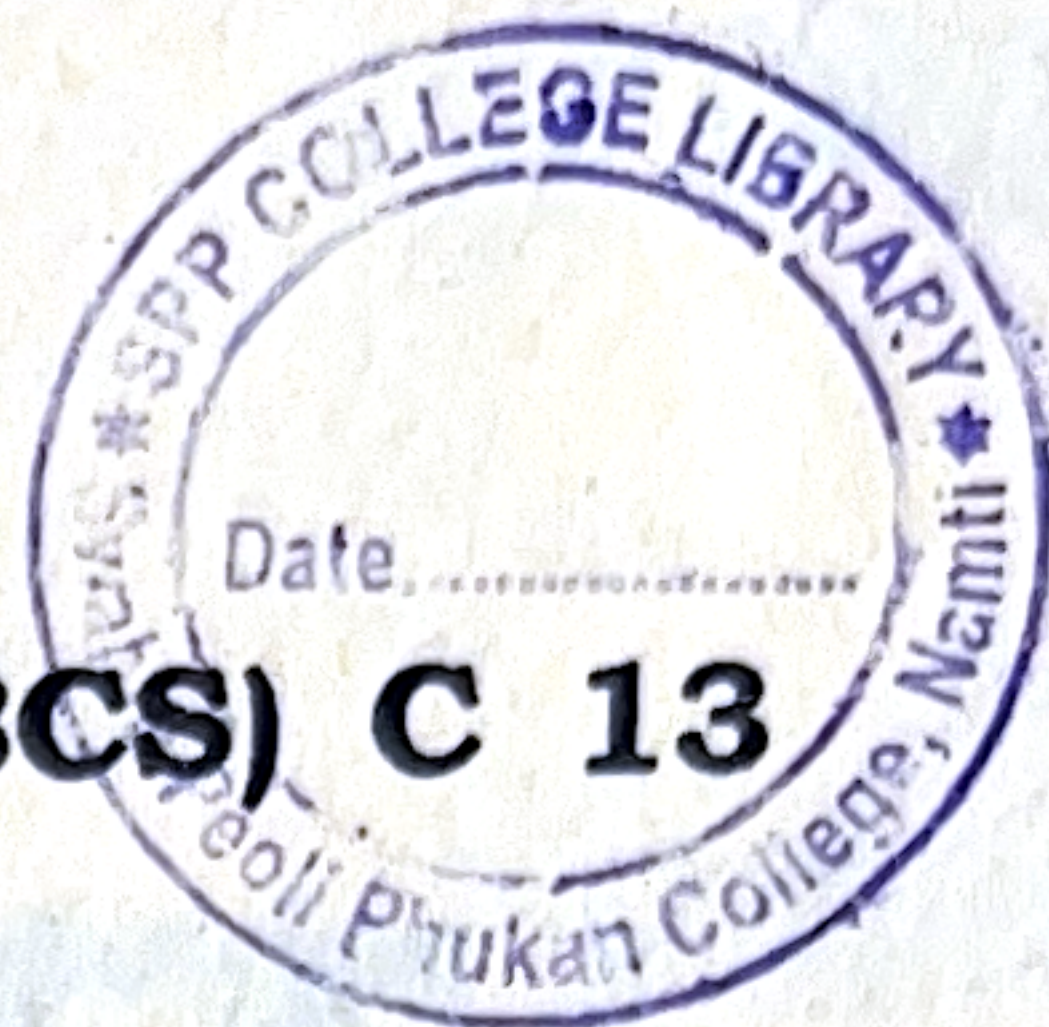


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**6 SEM TDC CHMH (CBCS) C 13**

**2025**

( May )

**CHEMISTRY**

( Core )

Paper : C-13

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

Full Marks : 53

Pass Marks : 21

Time : 3 hours

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

1. Choose the correct answer from the following : 1×7=7

(a) The total electron count for the complex  $[\text{Fe}_4\text{N}(\text{CO})_{12}]^-$  is

(i) 60

(ii) 62

(iii) 72

(iv) 59



- (b) EAN for  $[\text{CoNO}(\text{CN})_5]^{3-}$  is
- 35
  - 36
  - 37
  - 38
- (c) Which of the following has minimum trans-effect?
- $\text{H}_2\text{O}$
  - $\text{NH}_3$
  - Py
  - $\text{Cl}^-$
- (d) Which of the following complexes obeys  $18 e^-$  rule?
- $(\eta^5\text{-C}_5\text{H}_5)\text{Mn}(\text{CO})_3$
  - $\text{Cr}(\eta^5\text{-C}_5\text{H}_5)_2$
  - $\text{Co}_2(\text{CO})_8$
  - $\text{Fe}(\text{CO})_3(\eta^5\text{-C}_5\text{H}_5)$

- (e) Cations of which of the following groups are precipitated in alkaline medium?
- Group I
  - Group II
  - Group IV
  - None of the above
- (f) Which of the following combinations of basic radicals belongs to group III?
- Fe, Al, Cr
  - Fe, Mg, Ba
  - Mg, Ba, Ca
  - Mg, Ba, Fe
- (g) Find the hapticity of  $\text{C}_5\text{H}_5$  ligand in  $\text{Fe}(\text{C}_5\text{H}_5)_2$  complex.
- Monohapto ligand
  - Trihapto ligand
  - Pentahapto ligand
  - Dihapto ligand



2. Answer any *five* questions from the following:  
2×5=10

- (a) Why is  $H_2S$  passed in alkaline medium for the precipitation of group IV basic radicals? 2
- (b) Define solubility product and ionic product of a solution. 2
- (c) What is the importance of Zeise's salt in organometallic chemistry? How was it prepared? 1+1=2
- (d) Give an example of reaction in which  $HCo(CO)_4$  is used as a catalyst. 2
- (e) What is Wilkinson's catalyst? Mention one use of this catalyst. 2
- (f) How is 18  $e^-$  rule helpful in determining the number of metal-metal bonds in metal carbonyl compounds? 2

### UNIT—I

3. Answer any *two* from the following questions :  
3×2=6

- (a) How will you detect the presence of phosphate as interfering radical in a salt mixture? How does phosphate interfere in the detection of basic radicals? 1+2=3

( Continued )

- (b) What is common ion effect? Explain why during the precipitation of group III radicals,  $NH_4OH$  is added in presence of  $NH_4Cl$ . 1+2=3

- (c) What is the group reagent for group V? Write the chemical form of the precipitate of group V. How will you confirm the presence of  $Ba^{2+}$  ion in a salt mixture? 1+1+1=3

### UNIT—II

4. Answer any *four* from the following questions :  
3×4=12

- (a) The CO molecule has JR stretching frequency of  $2143\text{ cm}^{-1}$ , but it shifts to different regions in metal carbonyls. Explain. 3
- (b) What is Ziegler-Natta catalyst? Discuss its use in the polymerization of ethane. 1+2=3
- (c) What is synergic effect in metal carbonyls? Draw the molecular orbital energy-level diagram of CO molecule. 1+2=3
- (d) What is ferrocene? Write its preparation. Write the Friedel-Crafts acylation reaction of ferrocene. 1+1+1=3

( Turn Over )



( 6 )

- (e) Give one method of preparation for each of the following : 1+1+1=3
- (i) Metal carbonyl
  - (ii) Zeise's salt
  - (iii) Binuclear carbonyl

### UNIT—III

5. Answer any four from the following questions : 3×4=12

- (a) Write a note on acid hydrolysis of cobalt (III) compounds with suitable example. 3
- (b) Draw the structures of the intermediates that are formed in  $S_N1$  and  $S_N2$  mechanisms of  $[MA_3X]^{n+}$ . Compare their stability. 2+1=3
- (c) What is *trans*-effect? Outline the synthesis of *cis*- and *trans*-dichlorodiammineplatinum (0). How will you distinguish between them? 3
- (d) Explain the mechanism of the following : 3  

$$[L_5MX] \xrightarrow{\text{slow}} X + [L_5M] \xrightarrow[\text{fast}]{+Y} [L_5MY]$$
- (e) Explain the  $S_N1$  CB mechanism for the following reaction : 3  

$$[Co(NH_3)_5Cl]^{2+} + OH^- \rightarrow [Co(NH_3)_5(OH)]^{2+} + Cl^-$$

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( Continued )

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### UNIT—IV

6. Answer any two from the following questions : 3×2=6

- (a) Discuss Wilkinson's catalyst's role in hydrogenation of alkyne. 3
- (b) Discuss the method of synthesis of gas by metal carbonyl complexes. 3
- (c) Write a note on synthetic gasolin. 3

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