KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages) **Reg. No: ……**

Question Code: 26E02202 **Course Code: 24PMCH41**

PG Degree - End Semester Examinations, April 2026

Fourth Semester

M.Sc., CHEMISTRY

Coordination Chemistry-II

(For those who joined in July 2024 onwards)

Time: 3Hours **Maximum: 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer:

CO:1 K:1 1. The number of M-M bonds in $Mn_2(CO)_{10}$ is _____

(a) one (b) two

(c) three (d) zero

CO:1 K:2 2. Oxidation occurs very easily in case of

(a) $(\eta^5\text{-}C_5H_5)_2Fe$ (b) $(\eta^5\text{-}C_5H_5)_2Co$

(c) $(\eta^5\text{-}C_5H_5)_2Ru$ (d) $(\eta^5\text{-}C_5H_5)_2Os$

CO:2 K:1 3. The Oxidation state of Rhodium in Wilkinson catalyst is _____

(a) 0 (b) I

(c) II (d) III

CO:2 K:2 4. The oxidative addition and reductive elimination steps are favored by

(a) Electron rich metal centres. (b) Electron deficient metal centres.

(c) Electron deficient & electron rich metal centres respectively (d) Electron rich & electron deficient metal centres respectively

CO:3 K:1 5. Which of the following complex has minimum CO stretching frequency?

(a) $[Mn(CO)_6]^+$ (b) $[Cr(CO)_6]$

(c) $[V(CO)_6]^-$ (d) $[Ti(CO)_6]^{2-}$

CO:3 K:2 6. The ^{19}F NMR of BrF_5 gives_____

(a) two singlets (b) one doublet and one triplet

(c) one singlet and one quartet (d) one doublet and one quintet

CO:4 K:1 7. ESR spectroscopy is mainly applied to study

(a) diamagnetic compounds (b) paramagnetic species

(c) Noble gases (d) alkali metals

CO:4 K:2 8. In Mossbauer spectroscopy, the isomer shift provides information about _____

(a) molecular symmetry (b) electron density at nucleus

(c) molecular weight (d) bond strength

CO:5 K:1 9. Which of the following used to explain ionization energy to orbital energy in photoelectron spectroscopy?

(a) Hund's rule (b) Aufbau principle

(c) Pauli exclusion principle (d) Koopman theorem

CO:5 K:2 10. Circular Dichroism is used to determine _____

(a) molecular weight (b) bond length

(c) absolute configuration of chiral molecule (d) dipole moment

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 K:3 11. (a) Apply 18 electron rule to determine the stability of following complexes

i) $[Fe(CO)_5]$ ii) $[Co(CO)_4]$ and iii) $[Cr(CO)_6]$

(OR)

(b) Construct the structure of metal-Allyl complexes.

CO:2 K:3 12. (a) Select the mechanism of Oxidative addition and Reductive elimination.

(OR)

(b) Sketch the Tolman catalytic loop for the hydrogenation of alkene using suitable catalyst.

CO:3 K:4 13. (a) Analyse how IR spectroscopy is used in the structure determination of carbonyl compounds.

(OR)

(b) Examine the NMR spectroscopy used to assign fluxional behaviour of $[Fe(CO)_5]$?

CO:4 K:3 14. (a) Explain Kramer's degeneracy and zero field splitting.

(OR)

(b) Construct the Mossbauer spectrum of sodium nitroprusside.

CO:5 K:3 15. (a) Apply Koopman's theorem to explain how PES is used to determine ionization energy of the molecules.

(OR)

(b) Sketch and explain the PES of O_2 molecule.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 600 words.

CO:1 K:3 16. (a) Identify the structure and bonding of ferrocene.

(OR)

(b) Sketch the structure of Zeise's salt and choose its bonding.

CO:2 K:4 17. (a) Examine the role of Rhodium catalyst in the Monsanto process of acetic acid synthesis.

(OR)

(b) Inspect the catalytic cycle of Wacker process.

CO:3 K:5 18. (a) Deduce the coordination of i) Sulphato ii) Carbonato and iii) Thiourea with metal complexes using IR Spectroscopy.

(OR)

(b) Interpret the structure of the following compounds using NMR Spectroscopy

i) ^{19}F NMR of ClF_3 and SbF_5

ii) ^{31}P NMR of i) P_4S_3 ii) HPF_2 If $J_{P-H} > J_{P-F}$

CO:4 K:5 19. (a) Interpret the structure of Bis(salicylaldimine) Copper (II) complex using EPR spectroscopy.

(OR)

(b) Explain the Mossbauer spectrum of the following

i) $FeSO_4.7H_2O$ ii) $K_4[Fe(CN)_6]$ iii) $K_3[Fe(CN)_6]$ iv) $FeCl_3$

CO:5 20. (a) Inspect the PES spectrum of CO and CO_2 molecule.

K:4

(OR)

(b) Analyse the role of CD and ORD in structural elucidation.