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CENTRAL UNIVERSITY OF KARNATAKA
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Kadaganchi, Aland Road, Kalaburagi Dist-585367
Website: www.cuk.ac.in

School	Chemical Sciences
Department	Chemistry
Program	M.Sc
Semester	II (Repeater 2022 batch)
Course Code	PCHTCC2008

END SEMESTER EXAMINATIONS November 2025 (Repeater, 2022 Batch)

Course: Inorganic Chemistry-II	Max. Marks: 60	Duration: 2.5 hour	Credits: 4

Section A
Part-1: Answer any 10 questions ONLY (Each question carries 2 marks)

1. $CoCl_3 \cdot 6H_2O$ reacted with different amounts of ammonia to give many metal complexes. Draw all structures.
2. Write the IUPAC name for $K_3[Fe(CN)_6]$ and $[Co(en)_3]Cl_3$
3. Compute the hybridization of $[Ni(CN)_4]^{2-}$ using Valence Bond Theory?
4. What are the assumptions made for crystal field theory?
5. Draw all d-orbitals with proper +/- sign?
6. Write the CFSE of $K_3[Fe(CN)_6]$ and $[Ti(H_2O)_6]^{3+}$
7. Calculate the magnetic moments for Ni^{2+} and Mn^{2+}?
8. How many peaks are possible for $[Ti(H_2O)_6]^{3+}$ in the UV-visible spectrum?
9. What do you understand by the Nephelauxetic effect?
10. Draw the crystal field splitting diagram of trigonal bipyramidal $[Ni(CN)_5]^{2-}$?
11. Explain the Spin cross-over using suitable metal complex.
12. Draw Orgel diagram of $[Cr(H_2O)_6]Cl_2$
13. Arrange the following metal carbonyls in the order of increasing CO stretching frequency
    I) $[Mn(CO)_4]^{3-}$ II) $[Fe(CO)_4]^{2-}$ III) $[Co(CO)_4]^{-}$ IV) free CO

Part-2- Answer ANY 5 questions (Each question carries 5 marks)

14. Draw crystal field splitting diagram for octahedral and Tetrahedral and label them.
15. What are the factors affecting Δ_o? Explain with examples
16. Explain Jahn-Teller distortion (JTD) and its types in octahedral complexes.
17. a) Derive the Ground State symbol for Ni^{2+}, Mn^{2+} and Co^{3+}
    b) Write spin and Laporte selection rules for metal complexes
18. Draw MO diagram (σ-only) of octahedral complexes
19. Draw all the isomers for octahedral with different ligands [**M**abcdef]
20. Write all the microstates that are possible for d^2-system

Section B
Answer all questions

21. What is trans- effect? What product is obtained when $[PtCl_4]^{2-}$ is treated with: [3M]
    i) NH_3 followed by R_3P ii) R_3P followed by NH_3

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22. Arrange the following complexes in increasing order of inertness and justify your answer, $[Cr(CN)_6]^{3-}$ $[Mn(CN_6)]^{2-}$ $[Co(CN)_6]^{3-}$ $[Co(CN)_6]^{4-}$ [4M]

23. a) What are electron transfer reaction write its different types with examples. [5M]
b) Comment and compare the reactivity of $[Co(NH_3)_6]^{2+/3+}$, $[Ru(NH_3)_6]^{2+/3+}$ and $[Co(Phen)_3]^{2+/3+}$ towards electron transfer reactions.

24. Show the reaction sequence for the synthesis of hexammininecobalt (III) and hexammineine rhodium (III) cations. [3M]

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Program	M.Sc
Semester	II (Repeater 2023 Batch)
Course Code	PCHTC20500

END SEMESTER EXAMINATIONS, 12th November 2025 (Repeater 2023 Batch)

Course: Inorganic Chemistry-II	Max. Marks: 60	Duration: $2\frac{1}{2}$ hour	Credits: 4

Section A

Part-1: Answer any 5 questions (Each question carries 2 marks)

1. Compute the hybridization of $Fe(CO)_5$ using Valence Bond Theory.
2. Write the spectrochemical series of ligands
3. Derive the Ground State symbol for Mn^{2+}.
4. What are the evidences proved the presence of covalency in metal complexes?
5. How many microstates are possible for $\mathbf{d^2}$ system?
6. Explain Racah parameters A, B, C and factors that affecting them.
7. Arrange the following metal carbonyls in the order of increasing CO stretching frequency
   I) $[Mn(CO)_4]^{3-}$ II) $[Fe(CO)_4]^{2-}$ III) $[Co(CO)_4]^-$ IV) free CO

Part-2- Answer 4 questions (Each question carries 5 marks)

8. What are the factors affecting the magnitude of Δ_o? Explain with examples. **(5M)**
9. Calculate the CFSE of $[Mn(H_2O)_6]^{2+}$, $[NiF_6]^{2-}$, $[Fe(H_2O)_6]^{2+}$, $[RuH_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$ **(5M)**
10. Draw crystal field splitting pattern for square planar and cube geometries **(5M)**
11. Arrange the following metal complexes with increasing molar extinction coefficient, and offer explanation for your choice of order.
    $[Mn(H_2O)_6]^{2+}$, $[Ni(en)_3]^{2+}$, $K[MnO_4]$, $[Co(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$ **(5M)**
12. Draw Orgel diagram for $[Ni(H_2O)_6]^{2+}$ with proper labelling **(5M)**
13. What is Jahn-Teller distortion (JTD) ? Explain it with octahedral system. **(5M)**

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Section B

Answer all questions

14. **(a)** Give examples and write the structures for Metal complexes with Coordination numbers 1, 2 , 3 and 4. **(3M)**

(b) What is Berry's Pseudo Rotation, explain with one example. **(2M)**

15. **(a)** If an Octahedral complex undergoes distortion, how does it look like show schematically along with point groups. **(1+1 M)**

(b) Give an example for complex having Trigonal Prism geometry, draw the molecule.

16. **(a)** Discuss the cis/trans and optical isomerism in $[Co(ox)_2X_2]$ complexes. **(3M)**

(b) What is CD and ORD, explain the Cotton effect plots for $[Co(en)_3]^{3+}$ **(3M)**

(c) What is Linkage and Coordination isomerism? How do distinguish between two Linkage Isomers and coordination isomers. Explain with examples. **(3M)**

17. What is Chelate effect? How many chelate rings are present in each of the following complexes? Assume that all the donor atoms are involved in coordination. (a) $[Cu(trien)]^{2+}$; (b) $[Fe(ox)_3]^{3+}$; (c) $[Ru(bpy)_3]^{2+}$; (d) $[Co(dien)_2]^{3+}$; (e) $[K(18\text{-crown-}6)]^{+}$. **(5M)**

18. Classify the following as Hard and Soft Metal ions /Ligands:
RSH, Tl^{+}, F^{-1}, Cl^{-1}, H_2O,Li^{+}, Na^{+}, I^{-1} H^{-1}, R^{-1}, RNC K^{+} , Sc^{3+}, ROH, R_2O, $[OH]^{-1}$, $[RO]^{-1}Cr^{3+}$, Fe^{3+}, Co^{3+},$[CN]^{-1}$ (C-bound), Cu^{+}, ,CO (C-bound), R2S, $[RS]^{-1}$, $[SCN]^{-1}$ (S-bound), Ag^{+}, Au^{+}, $[ox]^{2-}$, R_3P, R3As : Justify your answer. **(4M)**

19. Write the names/formulae for the following metal complexes:

(a) $[Pt(py)_4][PtCl_4]$ **(b)** $Li[Ni(PF_3)_3I_3]$ **(c)** $[Co(NO_2)_3(dien)]$ **(5M)**

(d) Tris(thiourea)bismuth(III) nitrate **(e)** Tetraammine carbonato cobalt(III)chloride

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