Roll No. ..... Total Pages : 3

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May–2026

B.Sc. (Chemistry) IVth SEMESTER

Inorganic Chemistry-III

(BCH-401)

Time: 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Any other specific instructions.*

PART–A

1. (a) Distinguish between double salts and coordination compounds with example. (1.5)

   (b) Calculate CFSE for d^5 high spin octahedral complex. (1.5)

   (c) Write IUPAC name of $[Co(NH_3)_6]Cl_3$ and mention its isomerism. (1.5)

(d) What is spectrochemical series? (1.5)

(e) Define and give significance of Chelate effect. (1.5)

(f) Why tetrahedral complexes generally have smaller splitting than octahedral? (1.5)

(g) Differentiate between inert and labile complexes. (1.5)

(h) Why lanthanoids show +3 oxidation state predominantly? (1.5)

(i) What is the role of π-back bonding in metal carbonyls? (1.5)

(j) Why $[Ni(CN)_4]^{2-}$ is square planar while $[NiCl_4]^{2-}$ is tetrahedral. (1.5)

PART–B

2. (a) Explain Valence Bond Theory for octahedral complexes. Discuss limitations. (10)

(b) Predict geometry and magnetic behaviour of $[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$. (5)

3. (a) Discuss crystal field splitting in octahedral, tetrahedral and square planar complexes with diagram. (10)

(b) Calculate CFSE for d^4 and d^7 configurations in both weak and strong fields. (5)

4. Explain the Jahn-Teller effect and discuss its consequences on the geometry and properties of coordination compounds. (15)

5. (a) Differentiate between inner and outer orbital complexes with examples. (5)

(b) Discuss trans-effect and its theories. Also explain its application in synthesis of coordination compounds. (10)

6. (a) Discuss the chemistry of chromium and manganese in different oxidation states with reference to Potassium dichromate and Potassium permanganate. (10)

(b) Explain catalytic properties of transition metals with suitable examples. (5)

7. Discuss the chemistry of lanthanoids and actinoids including their electronic configurations and common oxidation states. Explain the origin and consequences of lanthanide contraction, and discuss their magnetic and spectral properties. Also describe the principle of separation by ion-exchange method. (15)
