2024
B.A./B.Sc.
Fourth Semester
CORE – 8
CHEMISTRY
Course Code: CHC 4.11
(Inorganic Chemistry - III)

Total Mark: 70 *Pass Mark: 28*
Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) Write the name of the following complexes: 1×4=4
   (i) $[Ag(NH_3)_2]Cl$
   (ii) $K_4[Fe(CN)_6]$
   (iii) $[Co(NH_3)_6]Cl_3$
   (iv) $[PtCl_4(NH_3)_2]$
   (b) Explain with examples, the two main geometries exhibited by coordination number four. 5
   (c) What do you mean by labile and inert complexes? 5

2. (a) Name the type of isomerism exhibited by the given complexes: 2×2=4
   (i) $[Co(NH_3)_6][Co(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$
   (ii) $[CoCl_2(Py)_2(H_2O)]Cl$ and $[CoCl_3(Py)_2(H_2O)]H_2O$
   (b) Based on VBT, find the geometry, hybridization, and magnetic properties of $[NiCl_4]^{-2}$. 5
   (c) What do you mean by chelate effect? Explain with an example. 5

UNIT–II

3. (a) Explain crystal field splitting of d-orbitals in octahedral complexes with neat diagrams. 5
   (b) Define CFSE. 1

(c) Calculate CFSE of the following: 2×4=8
(i) Mn^{+2} (octahedral & HS)
(ii) Fe^{+2} (octahedral & LS)
(iii) Co^{+2} (octahedral & HS)
(iv) Cr^{+2} (tetrahedral)

4. (a) Compare octahedral and tetrahedral complexes by taking their CFSE values and plot a graph. 6
(b) Explain the magnetic character of the following according to CFT.
(i) $[Fe(CN)_6]^{-4}$
(ii) $[Fe(H_2O)_6]^{+2}$ 1½×2=3
(c) Define Jahn-Teller distortion. Explain strong and weak JTD by taking suitable examples. 1+4=5

UNIT–III

5. (a) Why transition elements form many complexes? Give reason. 2
(b) Write notes on transition elements with respect to 2×3=6
(i) metallic character
(ii) melting and boiling points
(iii) atomic volume and densities
(c) What are the various oxidation states of manganese, cobalt, and iron? Give the most common oxidation state of them. 2×3=6

6. (a) What are the conditions of transition elements for stability of their complex compounds? 4
(b) Write notes on transition elements with respect to: 2×3=6
(i) Formation of coloured ions
(ii) Tendency to form complexes
(iii) Ionisation enthalpies
(c) What are the various oxidation states of vanadium? How would you account for them? 4

UNIT–IV

7. (a) Magnetic properties of lanthanoids differ from transition metals. Justify. 4

(b) What are actinoids? Discuss how you would prepare Np, Pu, and Am from U. 1+4=5

(c) Discuss the electronic configuration of lanthanoids. Give the electronic configuration of Ce, Pr, Eu, and Gd. 3+2=5

8. (a) Give a brief account on the colouration and complex formation tendencies of actinoids. 2+2 =4

(b) What is lanthanoid contraction? Discuss extraction of lanthanoids from monazite sand. 1+4=5

(c) Discuss the electronic configuration of actinoids and write the correct electronic configuration of U, Pu, Es, and Fm. 3+2=5

UNIT–V

9. (a) What are metalloenzymes? Explain any one of the metalloenzymes containing zinc as the metal ion. 2+4=6

(b) Write the use of chelating agent cisplatin in medicine. 5

(c) What is the role of iron in biological systems? 3

10. (a) Explain the structure of chlorophyll in detail. 6

(b) What is the biological role of calcium? 5

(c) Mention one trace element with its uses and adverse effects. 3