B. Sc. Chemistry Examination, 2022

(3rd Year, 5th Semester, CBCS, Supplementary)

Chemistry (Core)

Paper – Core Chem-Th- 11

Coordination Chemistry II; Colour Magnetism and Bioinorganic Chemistry + Trnsition Elements and Lanthna-noids and Actinoids

Time : Two hours Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each unit.

UNIT – 5111-I

Answer ***all*** questions.

1. a) Mention whether the structure of $NiCr_2O_4$ is Spinel or inverse Spinel? Discuss with proper justification. 2

   b) For the $[Cr(H_2O)_6]^{2+}$ ion, the mean spin pairing energy, P, is found to be 23,500 cm^{-1}. The magnitude of Δ_O is 13,900 cm^{-1}. Calculate the CFSE for this corresponding to high spin and low spin state. 2

   c) All Cr-F bond lengths are not equal in $[CrF_6]^{4-}$. Explain. 2

   d) Draw the Molecular Orbital energy level diagram for $[Ni(H_2O)_6]^{2+}$ ion. 4

2. a) Discuss the coordination environment of iron in oxygenated myoglobin and comment on the diamagnetic character of oxygenated myoglobin. 4

b) Explain the following. 4

i) In $[CoI_4]^{2-}$, $[CoBr_4]^{2-}$, $[CoCl_4]^{2-}$ the magnetic moments have been recorded as 4.77, 4.65 and 4.59 BM respectively which are higher than $\mu_{s.o} = 3.87$ BM. 2

ii) $[MnO_4]^{2-}$ is green and $[CrO_4]^{2-}$ is yellow. 2

c) Discuss the spectrum of copper(II) octahedral complex ion. 2

UNIT – 5112-I

3. a) With suitable diagrams explain the structure of TiO_2. What are such structures called? What property in TiO_2 enables it to be an effective photo-catalyst. $1+\frac{1}{2}+1$

b) Vanadium compounds display a lot of colour. Elaborate with examples. $1\frac{1}{2}$

c) Discuss the structure of $[VO(acac)_2]$. If a ligand coordinates to the sixth coordination site of the metal in the above what is the spectroscopic evidence for this? $1\frac{1}{2}+1$

d) With emphasis on bond lengths and bond angle discuss structure of $K_2Cr_2O_7$. What is obtained when its acidic solution is treated with H_2O_2 and the compound extracted with ether. $1\frac{1}{2}+1$

e) How can an octahedral and tetrahedral species be distinguished for Co(II) in solution? 1

4. Answer all questions : $2\times5=10$

a) Give example of rare earth metal ions in the following area:

i) Phosphor

ii) Superconductor

b) Periodic variation of enthalpy of atomization of lanthanide elements shows minima at Eu and Yb. Explain.

c) Calculate magnetic moment for Tb^{3+} ion.

d) Absorption bands of most of the Ln^{3+} ions are very weak but sharp when compared to those of d-block elements. Explain.

e) Th and U undergo radioactive decay but they are not rare. Explain.