Name:

Enrolment No:

UPES

End Semester Examination, May 2023

Course: Inorganic Chemistry III **Semester :** IV

Program: Integrated B Sc_M Sc Chemistry **Time : 03 hrs.**

Course Code: CHEM-2023 **Max. Marks: 100**

Instructions:

Write your Roll No. on the top immediately on receipt of this question paper.

There shall be three Sections (Section A, Section B and Section C) in the Question Paper & TWO pages.

Section A contains 5 Questions of 4 marks each. All are compulsory.

Section B- This section shall have 4 Questions of 10 marks each, Q9 has internal choice.

Section C shall have 2 Questions of 20 marks each, Q11 has internal choice.

SECTION A

(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	**a)** $[Cu(NH_3)_4]^{2+}$ is square planar, while $CuCI_4^{2-}$ is tetrahedral. Give reason. **b)** Why do transition metals acts as a good catalysts ?	**4**	**CO1** **CO2**
Q2	Calculate in $kJmol^{-1}$, the crystal field stabilization energy (CFSE) attained by Fe^{2+} ion in an octahedral oxide ion environment. Given, Δ_o, for Fe^{2+} in oxide ion environment is 124 $kJmol^{-1}$. What will be the value of CFSE in a tetrahedral environment of oxide ion.	**4**	**CO1**
Q3	Given below are the Latimer diagram for Cr in acidic medium: $Cr_2O_7^{2-} \xrightarrow{1.33} Cr^{3+} \xrightarrow{-0.41} Cr^{2+} \xrightarrow{-0.91} Cr$ Answer the following questions: **a)** Write the half reaction for the conversion, $Cr_2O_7^{2-} \longrightarrow Cr^{3+}$ **b)** Is there any tendency of Cr^{2+} reduce to Cr ? Give reasons. **c)** Calculate the skip step emf for $Cr^{3+} \longrightarrow Cr$ change.	**4**	**CO2**
Q4	What is lanthanoid contraction? What are the major consequences of lanthanoid contraction?	**4**	**CO3**
Q5	$^{235}_{92}U + \mathbf{A} \longrightarrow {}^{236}_{92}U + \mathbf{A} \longrightarrow \mathbf{B} \xrightarrow[t_{1/2}\ 6.7\ days]{\beta} \mathbf{C}$ Find **A, B** and **C** from the above reaction.	**4**	**CO3**

SECTION B

(4Qx10M= 40 Marks)

Q6	Explain the MO (molecular orbital) diagram for a complex of tetrahedral symmetry. Draw the correct structures of *cis*-$Pt(NH_3)_2Cl_2$ and *trans*-$Pt(NH_3)_2Cl_2$	**10**	**CO1**

Q7	Discuss trends in stability of oxidation states and magnetic properties of transition elements.	**10**	**CO2**
Q8	Describe ion exchange method for the separation and purification of the lanthanides.	**10**	**CO3**
Q9	Write the actinides in series with their atomic number, element correct name or symbol. Describe preparation of the actinides: **a)** Through nuclear fission of $^{235}_{92}U$ to Np isotopes and Pu isotopes. **b)** Isotopes of element Pu by succession of (n, γ) reactions. ***or*** Illustrate occurrence, extraction and uses of Uranium (U) and Thorium (Th) elements of actinide series.	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q10	**a)** Based on the VBT explain the geometry and magnetic property of a complex $[Fe(CN)_6]^{4-}$. **b)** From the following Latimer diagram, calculate the value of E° for the reaction: $2\ HO_2\ (aq) \rightarrow O_2\ (g) + H_2O_2\ (aq)$. $O_2 \xrightarrow{-0.125} HO_2 \xrightarrow{+1.510} H_2O_2$ Comment on the thermodynamic tendency of HO2 to undergo disproportionation.	**20**	**CO1 CO2**
Q11	**a)** Compare the general properties of actinides with lanthanides. **b)** How protactinium (Pa) is extracted and discuss (+IV) and (+V) oxidation states compound of Pa. ***or*** **a)** Illustrate chemical properties of Uranium (U) and discuss in brief about hydrides, oxides and halides of U. **b)** Discuss about occurrence, extraction and stable oxidation states of Neptunium (Np), Plutonium (Pu) and Americium (Am).	**20**	**CO3**