(b) Mention and draw structures of complexes (one each) that contains a VO^{2+} and a VO_2^+ unit in them. How is the presence of a V ═ O bond identified in such structures? 1½+½

(c) Explain what happens when $CrCl_3(THF)_3$ is allowed to react with $(CH_3)_3SiCH_2Li$ in a dry ether medium. Comment on the colour and nature of the products formed. What is unique about this reaction? ½+1+½

(d) What are the essential features that make the chromate ion a suitable indicator in chlorinity and/or salinity determination? 2

(e) In a titration of Fe^{2+} by MnO_4^- in the presence of a large excess of Cl^-, the formal potential of MnO_4^-/Mn^{2+} needs to be lowered for a logical completion of the titration. Why? How is this achieved? Discuss various aspects of modification necessary for this titration. ½+½+1

★★★

B. Sc. CHEMISTRY EXAMINATION, 2024

(5th Semester)

CHEMISTRY (CORE)

PAPER : CORE 11

Time : *Two Hours* *Full Marks* : 40

(*20 marks for each Unit*)

Use a separate answer scripts for each Unit.

The figures in the margin indicate full marks.

UNIT—5111 – I

1. Answer ***all*** questions :

(a) What do you mean by *z*-out and *z*-in distortion in coordination complexes? Can the square planer geometry be considered as a terminal case for the z-out distortion in an octahedral system? 2

(b) Why does Ni(II) always form four coordinated compound and any attempt to prepare six coordination complexes are mostly failed? What are the synthetic conditions that may lead to the formation of octahedral Ni(II) complex? 2+1

(c) "The heat of hydration of 3*d* dipositive metal ions are following the similar trends with the octahedral CFSE value of the corresponding metal ion" — Justify the statement. 2

(d) In case of $[ML_6]^{n+}$ compound, show the molecular orbital energy diagram considering six ligand group orbitals. Show the relevance of the CFT approach with this M.O. diagram. 3

2. *(a)* The electronic absorption spectrum of $[Co(OH_2)_6]^{2+}$ exhibits bands at 8100, 16000 and 19400 cm^{-1}. *(i)* Assign these bands to electronic transitions and *(ii)* Calculate the value of Δ_{oct} for $[Co(OH_2)_6]^{2+}$. 3

(b) Discuss the origin of color for *(i)* $CrO(O_2)_2$ and *(ii)* Prussian Blue. 2

(c) The $[Fe(CN)_6]^{3-}$ complex ion is expected to show the higher magnetic moment than $[Cu(H_2O)_6]^{2+}$ at room temperature. Explain. 1

(d) Why is the change from deoxyhaemoglobin to the oxy-form accompanied by a decrease in the observed magnetic moment? 2

(e) What is Minamata disease? 1

(f) Draw the active site structure of carboxypeptidase. 1

UNIT—5112 – I

3. Answer the following questions :

(a) The densities, melting and boiling points of lanthanide elements show a periodic variation reaching a minima at Eu and Yb. Explain. 2

(b) Calculate the magnetic moment of the Dy^{3+} system. 2

(c) Generally the absorption bands of Ln^{3+} ions are very weak but sharp when compared to those of *d*-block elements. Explain. 2

(d) Explain the ligand sensitized metal centered emission observed in Eu-benzoate system. 2

(e) Explain with an example the structure of a nine coordinated compound of Ln^{3+} ion. 1

(f) What were the nuclear fuels of the unfortunate atom bomb explosion incidents in Japan in 1945? 1

4. *(a)* With suitable diagrams, explain the structure of TiO_2. Discuss its role in controlling environmental pollution. 1+1

(OR)

Describe the structure of Ti_8C_{12}. Explain why such a structure is able to absorb 8 NH_3 molecules. 1½+½