

**6/CHE-350 Syllabus-2023**

**2026**

**( May-June )**

**FYUP : 6th Semester Examination**

**CHEMISTRY**

**( Inorganic Chemistry—II )**

**( CHE-350 )**

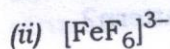
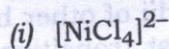
**Marks : 75**

**Time : 3 hours**

*The figures in the margin indicate full marks for the questions.*

1. (a) What are the drawbacks of valence bond theory and how are these defects rectified by crystal field theory? 5

(b) Explain the splitting of *d*-orbitals in octahedral field. Calculate crystal field stabilizing energy (CFSE) for the following : 5



(c) State and explain Jahn-Teller effect. Explain why  $\text{Cu(II)}$  complexes adopt a tetragonally distorted octahedral configuration.

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(d) How will you account for the non-existence of tetrahedral complexes with low-spin configuration? Give the sequence of energy level of  $d$ -orbitals in square planar crystal field.

4

OR

2. (a) Construct molecular orbital energy diagram for  $[\text{Co}(\text{NH}_3)_6]^{3+}$ . How does it explain the magnetic properties?

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(b) What are the factors which affect the magnitude of crystal field stabilising energy ( $10Dq$ )?

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(c) Explain why some metals have tendency to form mainly octahedral complexes whereas some others form both octahedral and tetrahedral complexes.

4

(d) Draw a schematic diagram of variation in the ionic radii of divalent cations of the metals of the first transition series. Why do the ionic radii of  $\text{Ca}^{2+}$ ,  $\text{Mn}^{2+}$  and  $\text{Zn}^{2+}$  show a smooth decrease whereas the ionic radii of other bivalent metal ions of the first transition series show an irregular pattern?

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3. (a) How can you prepare ferrocene? Explain why the aromatic character of ferrocene is different from benzene. 4
- (b) Explain the nature of metal-carbon bonding in metal carbonyl complexes with the help of an illustrated schematic diagram. 5
- (c) Discuss the mechanism for the hydrogenation of alkenes using Wilkinson's catalyst. 5
- (d) Explain with a suitable example each for an oxidative addition reaction and a reductive elimination reaction. 5

OR

4. (a) Verify that the metal atoms  $\text{Os}_3(\text{CO})_{12}$ ,  $\text{Fe}_3(\text{CO})_{12}$  and the two forms of  $\text{Co}_2(\text{CO})_8$  satisfy the EAN rule. 5
- (b) What are  $\pi$ -acid ligands? Show different modes of coordination of NO in metal nitrosyl. Explain why  $\text{NO}^+$  is a bad donor but good acceptor while  $\text{CN}^-$  is a good donor but a bad acceptor. 5
- (c) Discuss Monsanto process for the synthesis of acetic acid using rhodium carbonyl iodide catalyst. 5
- (d) Discuss one method of preparation and structure of  $\text{R}_3\text{SnX}$  and  $\text{R}_2\text{SnX}_2$ . 4

5. (a) What are the essential criteria for the essential elements? 4
- (b) What is dose-response curve? How do physiological effects vary with the change in concentration of essential and toxic elements? Explain with a suitable graph. 5
- (c) What are metalloporphyrins? How do the substituent group and redox properties affect the porphyrin ring in metalloporphyrins? 5
- (d) Discuss the possible mechanism involved in the hydrolysis of an amide linkage of a polypeptide using carboxypeptidase. 5

OR

6. (a) Write a short note on pH of biological fluids. 4
- (b) Why has myoglobin greater affinity for oxygen than hemoglobin and the reverse is true for  $\text{CO}_2$ ? Explain the cooperativity effect of oxygen bonding in hemoglobin. 5
- (c) Discuss the role of platinum complexes used as anticancer agents. Write the empirical rule governing platinum complexes having chemotherapeutic potential. 5

( 5 )

- (d) Discuss the main features of the structure of chlorophyll and its role in photosynthesis. 5
7. (a) What is trans effect? Write different theories to explain trans effect. 4
- (b) Write the mechanism of water substitution in octahedral complexes. What is the effect of non-replaceable anionic legands? 4
- (c) Explain stepwise and overall formation constants, and their relationships. How does steric hindrance cause anomalies in stepwise formation constants? 5
- (d) Discuss in detail the mechanism of racemization of tris-chelate complexes. Why does  $[\text{Co}(\text{en})_3]^{3+}$  racemise slowly but  $[\text{Cr}(\text{en})_3]^{3+}$  faster? 5

OR

8. (a) Discuss by giving suitable examples the types of intermediates that are formed in  $\text{S}_{\text{N}}1$ ,  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}1(\text{CB})$  mechanisms. 5
- (b) Discuss the substitution reactions in square planar complexes with emphasis on the influence of solvent, *cis*-effect and ionic potential of metal ion. 4

(c) Explain with example kinetic and thermodynamic controls in the formation of coordination compound reactions. Explain in what way the acid hydrolysis of  $\text{cis}[\text{Co}(\text{en})_2\text{Cl}(\text{OH})]^+$  complex differ from that of  $\text{trans}[\text{Co}(\text{en})_2\text{Cl}(\text{NO}_2)]^+$  complex.

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(d) What are the factors affecting the reactivity of co-ordination compounds?

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