



**M.Sc. II Semester Degree Examination, Sept./Oct. - 2024**

**INDUSTRIAL CHEMISTRY**

**DSC - 5 : Coordination Chemistry**

**(NEP)**

Time : 3 Hours

Maximum Marks : 70

**Note :** (i) Answer **any five** questions including **Q.No.1**.  
(ii) **Q.No.1** is **compulsory**.

1. (a) Depict MO diagram and discuss briefly the formation of both sigma and pi bonding in  $[\text{Cr}(\text{CO})_6]$ .  
(b) Write salient features and short comings of CFT.  
(c) What is CFSE ? Determine CFSE of  $d^4$  and  $d^6$  configurations in high spin and low spin cases.  
(d) Write short notes on the following :  
(i) Spectrochemical series and  
(ii) Nephelauxetic series **4+3+3+4=14**
2. (a) Write the selection rules for electronic spectra of coordination complexes. How are Orgel diagrams plotted ? Discuss electronic spectra using Orgel diagram for one electron and one hole systems in octahedral and tetrahedral complexes.  
(b) Explain ferro and antiferro magnetism. How are these different from paramagnetism ? What is the effect of temperature on magnetism of all these materials ?  
(c) Discuss the types of CT transitions possible in coordination compounds. Give an example for each. **5+5+4=14**
3. (a) Distinguish between stepwise and overall formation constants ? How are they related ? Explain briefly the determination of stability constant using pH metric method.  
(b) Discuss the kinetics and mechanism of ligand substitution reactions in square planar complexes.  
(c) What are inner sphere electron transfer reactions ? Explain steps involved in the mechanism of these reactions through an example. **5+5+4=14**



4. (a) Compare the structures and functions of haemoglobin and myoglobin. How their structures enable them to uptake, transport and storage of dioxygen in biological systems ? Explain.
- (b) Discuss the structure and functions of nitrogenase. Explain abiological nitrogen fixation.
- (c) Comment on the structure and biological roles of hemerythrin and hemocyanin. **5+5+4=14**
5. (a) What is radioactivity ? Discuss the applications of radioactivity with reference to the elucidation of reaction mechanism and kinetics of exchange reactions.
- (b) Explain the following :
- (i) Mass defect
- (ii) Binding energy
- (c) Write a note on neutron absorptiometry. **5+5+4=14**
6. (a) Draw Orgel diagram for  $d^5$  systems. Discuss the electronic spectrum of  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ .
- (b) Discuss the magnetic and spectral properties of lanthanides.
- (c) What are non-complementary electron transfer reactions ? Give two examples. **5+5+4=14**
7. (a) Discuss the effect of following factors on the stability of metal complexes :
- (i) Charge and size of the metal ion
- (ii) Chelate effect and
- (iii) Macro cyclic effect
- (b) Write systematic representation of the following electron transfer reactions showing oxidant and reductant species. Compare and contrast on the rate constants :
- $$[\text{Co}(\text{NH}_3)_6]^{2+} / [\text{Co}(\text{NH}_3)_6]^{3+} k = 1 \times 10^{-6} \text{ M}^{-1} \text{ s}^{-1}$$
- $$[\text{Co}(\text{phen})_3]^{2+} / [\text{Co}(\text{phen})_3]^{3+} k = 40 \text{ M}^{-1} \text{ s}^{-1}$$
- $$[\text{Ru}(\text{NH}_3)_6]^{2+} / [\text{Ru}(\text{NH}_3)_6]^{3+} k = 8.2 \times 10^2 \text{ M}^{-1} \text{ s}^{-1}$$
- (c) Give the structural representation and active sites of 2Fe-2S and 4Fe-4S ferridoxins. Comment on their magnetic behaviour in both oxidized and reduced forms. **5+5+4=14**
8. (a) Give an account for the following : Bhor effect and Z-Scheme.
- (b) Explain the principle and applications of NAA. What is the difference between PGNA and DGNA ?
- (c) Write a short note on applications of radio isotopes in medicine with examples. **5+5+4=14**

