

AV-1962

**M.Sc. (Part—I) Semester—II (CBCS Scheme) Examination**  
**INORGANIC CHEMISTRY (Old) (Upto Winter-2018)**  
**(Co-ordination Chemistry)**

**Paper—V**

Time : Three Hours]

[Maximum Marks : 80

- N.B. :—** (1) All questions carry equal marks and are compulsory.  
(2) Use of scientific calculator is allowed.

**UNIT—I**

1. (a) Draw correct molecular orbital diagram of  $[\text{CoF}_6]^{3-}$  ion and explain its paramagnetic behaviour. 6
- (b) What are charge transfer spectra ? Explain their different types with suitable examples. 5
- (c) Give the comparison between CFT and MOT. 5

**OR**

- (p) Explain  $\sigma$ -bonding molecular orbital diagram for  $[\text{NiCl}_4]^{2-}$ . 6
- (q) Write the six “symmetry adapted linear combinations” of the ligand orbitals with respect to metal orbitals. 5
- (r) What are the failures of ionic model of CFT ? 5

**UNIT—II**

2. (a) Derive the ground terms for  $d^2$  and  $d^3$  ions. 6
- (b) Three absorption bands at 8,400, 17,950 and 20,100  $\text{cm}^{-1}$  are observed in the spectrum of Co(II) complex. Calculate the value of B,  $\beta$ , 10 Dq and %  $\beta$ . The B for free Co(II) ion is 971  $\text{cm}^{-1}$ . 5
- (c) Though Mn in  $\text{KMnO}_4$  has  $d^0$  configuration it is coloured. Explain. 5

**OR**

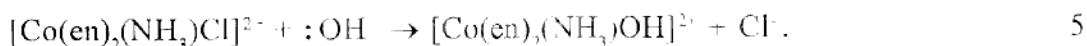
- (p) What is meant by nephelauxetic effect ? How does this effect ? Explain the contribution of covalent character in M–L bonding. 5
- (q) Explain the electronic spectra of  $[\text{V}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  on the basis of Orgel diagram. 5
- (r) Write the Mulliken symbols for S, P, D and F states both in octahedral field. Also explain the electronic transition in  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  ion using Mulliken symbols. 6

### UNIT—III

3. (a) Discuss the various factors affecting lability of complexes. 6
- (b) Discuss the mechanism of acid hydrolysis of an octahedral complex of  $\text{Co}^{3+}$  ion. 5
- (c) Explain with examples the  $\text{S}_\text{N}1$  and  $\text{S}_\text{N}2$  mechanism for octahedral complexes. 5

#### OR

- (p) Why most of an outer orbital octahedral complexes are labile while inner orbital octahedral complexes are inert ? Explain. 6
- (q) What is anation reaction ? Explain its mechanism with suitable example. 5
- (r) Discuss  $\text{S}_\text{N}1\text{CB}$  mechanism for the following reaction : 5



### UNIT—IV

4. (a) Discuss Marcus-Hush theory of electron transfer. 6
- (b) What are the factors affecting rate of substitution reaction in square planar complexes ? 5
- (c) Suggest the suitable routes for the preparation of cis- and trans-  $[\text{PtCl}_2(\text{NH}_3)(\text{PPh}_3)]$  from  $[\text{PtCl}_4]^{2-}$ . 5

Given : Order of trans effect is  $\text{NH}_3 < \text{Cl}^- < \text{PPh}_3$ . 5

#### OR

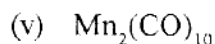
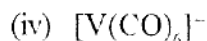
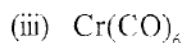
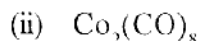
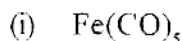
- (p) Discuss the electrostatic polarization theory of trans effect. 5
- (q) Write brief note on photochemical reactions in Ruthenium complexes. 5
- (r) What are complementary and non-complementary electron transfer reactions ? Explain with suitable examples. 6

### UNIT—V

5. (a) How IR vibrational frequencies are used to distinguish terminal and bridging carbonyl groups in metal carbonyls ? Explain with examples. 6
- (b) What are fluxional molecules ? Discuss the structure and bonding in  $\eta^3$ -allyl complexes. 5
- (c) Explain the role of  $[\text{HCo}(\text{CO})_4]$  as a catalyst in hydroformylation reaction. 5

#### OR

- (p) What is EAN rule ? Calculate EAN for metals in the following metal carbonyls :



- (q) Discuss the important reactions of transition metal nitrosyls. 5
- (r) Explain with mechanism, the role of Wilkinson's catalyst for the following reaction : 5

