

(2½ Hours)

- N.B. : (1) All questions are compulsory.  
 (2) Figures to the right indicate full marks.

1. (a) Attempt any two of the following.
- (i) Explain the photometric and conductometric methods used for the determination of rate of reaction. 4
  - (ii) Define 'trans effect' and discuss the electrostatic polarization theory in square planar complexes. 4
  - (iii) Describe the mechanism of 'inner sphere' electron transfer reaction in octahedral complexes. 4
  - (iv) Discuss the cis-trans isomerisation reactions in co-ordinate complexes. 4
- (b) Attempt any one of the following.
- (i) Explain the substitution reactions in octahedral complexes without breaking of metal-ligand bond. 4
  - (ii) Describe the effect of the following on the rate of substitution reactions in square-planar complexes. 4
    - (1) Nature of the solvent.
    - (2) Nature of the leaving group.
- 2 (a) Attempt any two of the following.
- (i) Describe the preparation of Zeise's salt. Draw the structure and explain its salient features. 4
  - (ii) Give one synthesis of alkynes organometallic complexes. What role do metal complex play in oligomerization of alkynes? 4
  - (iii) Explain the bonding in Fisher and Schrock carbenes in combination with metal orbitals. 4
  - (iv) What is 16 electron rule? With the help of electron count, explain which of the following complexes obey the rule. 4
    - (a)  $[\text{Ni}(\eta^3\text{-C}_3\text{H}_5)_2]$
    - (b)  $[\text{Cr}(\text{CO})_3(\eta^6\text{-C}_6\text{H}_6)]$
- (b) Attempt any one of the following.
- (i) Give one method of synthesis of diallyl nickel complex. Draw and explain its structure. 4
  - (ii) What is an organometallic compound? Give the synthesis of cyclopentadiene complexes of iron. 4

(TURN OVER)

- 3 (a) Attempt any two of the following.
- (i) Define the term nanoparticles. Explain the Langmuir Blodgett method for the preparation of nanomaterial. 4
  - (ii) On the basis of band theory, explain electrical conductivity of alkali and alkaline earth metals. 4
  - (iii) Explain ceramic method for synthesis of inorganic material with a suitable example. State its merits and demerits. 4
  - (iv) Draw the structure and discuss salient features of  $\text{CaF}_2$ . 4
- (b) Attempt any one of the following.
- (i) Explain the origin of second Brillouin zone in K space and diffraction of electron from (100) plane with the help of diagram. 4
  - (ii) How are nanomaterials classified? Discuss the microwave method for preparation of nanomaterials. 4
- 4 (a) Attempt any two of the following.
- (i) Explain Job's method for the determination of stepwise formation constant of metal complexes. 4
  - (ii) Discuss the electronic spectra exhibited by  $[\text{CrF}_6]^{3-}$ . 4
  - (iii) Explain the ESR spectra of tetragonal Cu(II) complexes. 4
  - (iv) With reference to IR spectroscopy, discuss the nature of metal-sulphur bond in complexes. 4
- (b) Attempt any one of the following.
- (i) Explain the electronic spectra of square planar Pd(II) complexes. 4
  - (ii) Describe the nature of metal sulphur bond in complexes on the basis of Raman spectroscopy. 4
- 5 Attempt any four of the following.
- (a) Explain the ligand substitution reaction in tetrahedral  $[\text{FeBr}_4]^-$  by a  $\text{X}^-$  ligand. 12
  - (b) Write a note on complementary and noncomplementary reactions.
  - (c) What are Arene organometallic complexes? Discuss the structure of one of the Arene complexes.
  - (d) Give any one method of preparation of bis(triphenyl phosphine) diphenylacetylene platinum (0) complex.
  - (e) Describe sol-gel method for preparation of inorganic materials.
  - (f) Draw the structure and discuss the salient features of  $\text{TiO}_2$ .
  - (g) Write a short note on biological applications of ESR.
  - (h) Discuss the mole ratio method for determination of stepwise formation constant of metal complexes.