(2½ Hours) [Total Marks : 60

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 mechanisms of isomerisation reactions in coordinate complexes. 4
(ii) What is trans effect ? Explain pi-bonding theory with respect to substitution reaction in square planar complexes. 4
(iii) How does racemisation reaction take place in co-ordinate complexes ? Illustrate with an example. 4
(iv) Write a note on Marcus theory in outer sphere reactions. 4
(b) Attempt any one of the following :–
(i) Explain the ligand substitution reactions in the complex $[Fe\ Br_4]^-$ by a PPh_3 ligand. 4
(ii) With respect to square planar complexes, describe the following factors :– 4
(1) Nature of the solvent
(2) Nature of the leaving ligand.

2. (a) Attempt any two of the following :–
(i) Give one method of sysnthesis of any two representative reaction and one important application of metal-alkyne complex 4
(ii) How is ferrocene prepared by using cyclopentadienyl Grignard reagent ? Write the following chemical reactions of ferrocene :– 4
(1) Sulphonation
(2) Acylation.
(iii) On the basis of Valence Bond Theory, explain the structure and bonding in dibenzene chrominm (0). 4
(iv) Describe the preparation of Zeise's salt. Draw the structure and explain it's salient features. 4
(b) Attempt any one of the following :–
(i) Give one method of synthesis of diallyl nickel complex. Draw and explain the structure of it. 4
(ii) Explain the half sandwich complex with an example. 4

3. (a) Attempt any two of the following :–
(i) Elaborate on the ceramic method for the synthesis of inorganic materials with a suitable example. Give merits and demerits of it. 4
(ii) What are the possible structures shown by AB_2 type of inorganic compounds ? Discuss the structure of calcium fluoride molecule. 4

P.T.O.

(iii) On the basis of band theory, explain the electrical conductivity of alkali and alkaline earth metals. 4

(iv) Define the term "nanoparticles". How will you prepare nanoparticles by Langmuir Blodgett method ? 4

(b) Attempt any one of the following :–

(i) Explain the parabolic relationship between energy (E) and wave number (K) of a free electron in light of band theory. 4

(ii) Discuss the precursor method for the preparation of inorganic materials with one suitable example. What are the disadvantages of this method ? 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 $[Ni\ (H_2O)_6]^{2+}$ complex ion. 4

(iii) With reference to Infra - Red spectroscopy, describe the nature of metal - S bond using two examples. 4

(iv) Write a note on the nature of metal - oxygen bond with reference to Raman spectroscopy. 4

(b) Attempt any one of the following :–

(i) Explain the structure of $CuSiF_6.6H_2O$ by ESR spectroscopy. 4

(ii) Discuss the electronic spectra exhibited in the compound of Al_2O_3 containing Cr+3 ion as an impurity. 4

Attempt any four of the following :– 12

(a) Explain the two factors (i) charge of complex (ii) geometry of complex, affecting the rate of reaction.

(b) Give the mechanism of ligand substitution reaction of octahedral compelxes without breaking of metal ligand bond.

(c) What is sixteen electron rule ? On the basis of electron count show whether following complexes obey this rule :–

(i) $[Ir\ Br_2\ (CH_3)\ (CO)\ PPh_3]$

(ii) $[Ni\ (\eta^3\text{-}(C_3H_5)_2]$

(d) Explain the structure of bis (tripheny phosphine) diphenylacetylene Platinum (0) complex.

(e) Discuss the k space with reference to band theory.

(f) Explain the principle of coprecipitation method for the preparation of nanoparticles.

(g) Give the three important applications of ESR spectroscopy in inorganic chemistry.

(h) With the principle of Raman spectroscopy, discuss the nature of metal - N bond in a complex.
