Q.P. NO : **08724**

(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) Define rate of reaction. Discuss any two factors affecting rate of reaction. 4
   (ii) Explain the π bonding theory of trans effect. 4
   (iii) Discuss the mechanism of outer sphere electron transfer reaction with suitable example. 4
   (iv) Explain the mechanism of racemisation reaction in complexes. 4

1. (b) Attempt any **one** of the following.
   (i) Discuss the substitution reaction of octahedral complexes without breaking of metal-ligand bond. 4
   (ii) What are complementary and non complementary reactions? Classify the following as complementary and non complementary. Justify your answer. 4 4
   (1) $2Fe^{+3} + Sn^{+2} \rightleftharpoons 2Fe^{+2} + Sn^{+4}$ 4
   (2) $Tl^{+3} + 2Fe^{+2} \rightleftharpoons Tl^{+} + 2Fe^{+3}$
   (3) $Sn^{+2} + Hg^{+2} \rightleftharpoons Sn^{+4} + Hg^{0}$

2. (a) Attempt any **two** of the following.
   (i) Give one method of preparation and two chemical properties of each alkyl and aryl derivates of organometallic compounds. 4
   (ii) What are the different types of organometallic carbenes? Give resonance structures of different types of carbenes. 4
   (iii) Why are cobaltocene and nickelocene less stable than ferrocene? 4
   (iv) Write two methods of prepa ation of dibenzene chromium (0). Explain it's structure and bonding on the basis of Valence Bond Theory. 4

2. (b) Attempt any **one** of the following.
   (i) Write a note on sandwich and half-sandwich complexes. 4
   (ii) State 16 electron rule. With the help of electron count, explain which of the following complexes obey the rule. 4
   (a) $[RhCl(PPh_3)_3]$
   (b) $\left[\eta^1 - C_5H_5Mn\ (CO)_5F_2\right]$

(TURN OVER)

3. (a) Attempt any **two** of the following.

(i) Explain the origin of first Brilloun zone in K space and diffraction of electron from (100) planes with the help of a diagram. 4

(ii) Describe the precursor method for the preparation of inorganic materials. State its merits and demerits. 4

(iii) Discuss the structure and the salient features of Nickel arsenide. 4

(iv) How are nanomaterials prepared by using microorganisms? 4

3. (b) Attempt any **one** of the following.

(i) On the basis of band theory, explain the electrical property of lithium and beryllium metal. 4

(ii) Write a note on applications of nanomaterials in the field of semiconductors and solar cells. 4

4. (a) Attempt any **two** of the following.

(i) Discuss the mole-ratio method for the determination of stepwise formation constant of metal complexes. 4

(ii) Explain the nature of metal-oxygen bond with reference to IR Spectroscopy using two examples. 4

(iii) Discuss the ESR Spectra of octahedral Cu(II) complexes. 4

(iv) Describe the electronic spectra exhibited by $[Cr(NH_3)_6]^{3+}$ 4

4. (b) Attempt any **one** of the following.

(i) Explain the nature of metal-sulphur bond in complexes by Raman Spectroscopy. 4

(ii) Discuss the electronic spectrum exhibited by square planar Ni (II) Complexes. 4

5 Attempt any **four** of the following. 12

(a) Describe the mechanism of substitution of CO by PPh_3 in $[Ni(CO)_4]$

(b) Explain the effect of nature of leaving group on the rate of substitution reaction of square planar complexes.

(c) Give one method of preparation of bis (triphenyl phosphine) diphenyl acetylene platinum (0). Describe it's structure.

(d) How is diallyl nickel complex prepared? Explain it's structure.

(e) Explain the ceramic method for the preparation of inorganic materials.

(f) Discuss the structure and the salient features of CaI_2.

(g) Describe Job's method for the determination of stepwise formation constant of metal complexes.

(h) Write a note on applications of ESR in biological systems.
