AU–315

M.Sc. (Part—I) Semester—II (CBCS Scheme) Examination

CHEMISTRY (Old) (Upto Winter—2018)

(Physical Chemistry—II)

Paper—VII

Time : Three Hours] [Maximum Marks : 80

N.B. :— (1) **ALL** questions are compulsory and carry equal marks.

(2) Use of log table and calculator is permitted.

1. (a) Explain the kinetics and mechanism of photochemical reaction between H_2 and Br_2. 8

(b) What are fast reactions ? Explain nuclear magnetic resonance method. 8

OR

(p) Discuss the flash photolysis technique for the study of fast reactions. 8

(q) Discuss Lotka-Volterra mechanism for oscillating reactions. 8

2. (a) By applying HMO theory to cycle-butadiene system derive an expression for delocalization energy. 8

(b) Construct sp^2 hybrid orbitals by combining one 2s and two 2p atomic orbitals and establish the value of angle between the hybrid orbitals. 8

OR

(p) Apply HMO theory to ethylene molecule and find out the HMO energies. 6

(q) What are the basic criteria for formation of M.O.s from A.O.s ? Construct M.O.s by LCAO for H_2^+ molecule ion. 6

(r) Explain the physical picture of bonding and antibonding wave functions. 4

3. (a) Discuss the phenomena of polymerization and kinetics of polymerization. 6

(b) Give a brief account of stability of biological polymers. 4

(c) Explain light scattering method to determine molar mass of polymer. 6

OR

(p) A protein sample consists of an equimolar mixture of ribonuclease ($M = 13.7$ kg mol^{-1}) hemoglobin ($M = 15.5$ kg mol^{-1}). Calculate number average and mass average molecular mass of sample. 4

(q) Discuss polymers with respect to configuration and conformations of macromolecules. 6

(r) Discuss size exclusion chromatography method. 6

4. (a) What are the different methods used for monitoring and prevention of corrosion ? 6

(b) Discuss Debye Huckel Onsager treatment and its extension. 6

(c) Explain the formation of electric double layer with respect to electrode solution interface. 4

OR

(p) Discuss :

(i) Electron transfer processes

(ii) Electron Tunneling. 6

(q) Explain voltammetry, experimental techniques involved. Also explain concentration polarization phenomenon. 6

(r) Discuss the structure of electrified interfaces and electric potentials generated at the interfaces. 4

5. (a) Derive an expression for translational partition function for H_2 molecule at room temperature. 6

(b) Calculate the value of molecular rotational partition function for $N_2(g)$ at 298 K. The moment of inertia is 1.407×10^{-46} kg m^2 and the symmetry number is 2 for $N_2(g)$. Given :

$K = 1.381 \times 10^{-23}$ JK^{-1}

$h = 6.626 \times 10^{-34}$ J. 4

(c) Define the concept of distribution and thermodynamic probability. 6

OR

(p) Calculate translational partition function of H_2 molecule confined to a 1000 cm^3 vessel at room Temp (T = 25°C). 4

(q) Compare microcanonical, canonical and grand canonical ensemble based on their thermodynamic environment. 6

(r) Derive an expression for vibrational partition function and give applications of partition functions. 6