



**JBF-003-010103**

Seat No. \_\_\_\_\_

**M. Sc. (Sem. I) (CBCS) Examination**

**December - 2019**

**Chemistry : C - 103**

*(Physical Chemistry) (Old Course)*

**Faculty Code : 003**

**Subject Code : 010103**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.  
(2) All questions carry equal marks.

**1** Answer the following : (any seven)

- Define : Fugacity, Thermodynamic probability, ideal solution, Debye length.
- Deduce the free energy function in terms of partition function.
- State the postulates of Debye-Huckel theory.
- State the equation for the determination of molecular weight by freezing point depression method with significance of the symbols.
- Discuss the determination of standard potential of Cu/Cu<sup>2+</sup>.
- Explain generalized method for the determination of fugacity of a pure gas.
- What are the different forms of equilibrium constants and corresponding 1 functions.
- Explain briefly properties of ideal solutions.
- Calculate the ionic strength of (a) 0.01 N sodium sulfate and (b) 0.005 N aluminium chloride solutions.
- What are the assumptions made in the derivation of freezing point depression equation.

**2** Answer the following : (any two)

- Discuss the effect of an inert electrolyte on the solubility of a sparingly soluble salt. The solubility of silver iodate in pure water at 25°C is  $1.771 \times 10^{-4}$  mol lit<sup>-1</sup>. Calculate the solubility in presence of 0.005, 0.01 and 0.02 mol lit<sup>-1</sup> KNO<sub>3</sub>. (A = 0.509).

- (b) Prove that  $\beta=1/kT$ .
- (c) Mixture of benzene and toluene behaves almost ideally at 30°C. The vapor pressure of pure benzene is 118.2 mm and that of toluene is 36.7 mm. Plot total vapor pressure against mole fraction composition of liquid and vapor for ideal solution and determine the composition of benzene in vapor and in liquid state at total pressure equal to 80 mm.

3 Answer the following :

- (a) Show that there is no change in enthalpy and volume upon mixing the components of an ideal solution.
- (b) Discuss Van't Hoff reaction isotherm.
- (c) Explain Lewis- Randell's Rule.

**OR**

- 3 (a) Determine the vibrational partition function of carbon dioxide at 25°C. Vibrational frequencies are 667, 667, 1340 and 2349  $\text{cm}^{-1}$ .
- (b) Write note on Duhem- Margules equation.
- (c) Discuss activity and activity coefficient in liquid solutions and their variation with temperature and pressure.

4 Answer the following : (any **three**)

- (a) Derive an expression for the equilibrium constant of a metathetic reaction.
- (b) Discuss osmotic coefficient and D-H theory.
- (c) Calculate the total standard entropy of HCl using following data :  $\sigma = 1, I = 2.66 \times 10^{-40} \text{gcm}^2, \omega = 2989 \text{cm}^{-1}, T = 300 \text{K}$ .
- (d) Show that in dilute solutions, solvent obeys Raoult's law and solute obeys Henry's law:

5 Answer the following : (any **two**)

- (a) Describe standard heat of formation of ions.
- (b) Derive the following relation :  $C_v = \partial/\partial T \left[ RT^2 (\partial \ln Q / \partial T)_v \right]$ .
- (c) Derive an expression for the determination of true equilibrium constant for a weak acid from conductance measurement using D-H limiting law.
- (d) Discuss the determination of dissociation constant of water by EMF method.