HEI-003-1101003 Seat No. _____

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

November / December - 2017

Physical Chemistry : Paper - C - 103

(New Course)

Faculty Code : 003

Subject Code : 1101003

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**)

(a) Define : Fugacity, Thermodynamic probability, Ionic strength, Chemical cell.

(b) Fill in the blanks :

(i) The solubility of sparingly soluble salt _____ in presence of an inert salt.

(ii) Rotational partition function depends on temperature and _____.

(iii) The total-pressure of binary solution varies _____ with mole fraction of any constituent in vapor phase.

(iv) The activity of a solution is equal to the product of concentration and _____.

(c) Explain Debye-Huckel equation for concentrated solutions.

(d) Discuss zinc silver accumulator.

(e) State the assumptions made in the derivation of Boltzmann distribution law.

(f) Define Raoult's law and dilute solution. What is the difference between ideal solution and dilute solution ?

(g) Discuss the effect of pressure on fugacity of mixture of gases.

(h) Show that internal energy $E = 3/2\,RT$ for monoatomic gas and $E = RT$ for diatomic gas.

(i) Derive an expression relating Partition function and work function.

(j) In 100 g of water, when 10 g of a substance of molecular weight 186 is dissolved, it lowers the freezing point by 1 °C. Calculate the molal freezing point constant of water.

2 Write notes on : (any three)

(a) Applications of Debye-Huckel limiting equation

(b) Graphical method for the determination of fugacity of a gas

(c) Properties of ideal solutions

(d) Lead accumulator.

3 (a) Derive an expression : $\beta = 1/kT$.

(b) Discuss the effect of inert electrolyte on the solubility of sparingly soluble salt. Following data are given for the mean ionic activity coefficient for an acid : **4**

m :	0.001	0.005	0.01	0.02	0.05
$\gamma\pm$:	0.966	0.928	0.905	0.875	0.830

Determine the mean ionic diameter (a) graphically provided that B is 0.329×10^8.

OR

3 (a) What is liquid junction potential ? Derive an expression for the determination of liquid junction potential.

(b) Derive an expression for the determination of fugacity by equation of state method. Utilize the following data to calculate fugacities of a gas at various pressures at 0 °C.

P :	50	100	200	400	800	1000
PV/RT :	0.9846	0.9946	1.0365	1.2552	1.7959	2.0641

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

(a) Derive an expression for the determination of mean activity coefficient for a dilute solution.

(b) Discuss equilibrium constant of metathetic reactions.

(c) Explain Lewis Randell's rule.

(d) Derive the expression : $P = p_2' + N_1 \left(p_1' - p_2' \right)$

5 Answer the following : (any two)

(a) Discuss The Sackur-Tetrode Equation.

Calculate the rotational partition function for ammonia at 25°C. (I_A = 2.78 × 10^{-40} $g.\ cm^2$, I_B = 0.78 × 10^{-40} $g.\ cm^2$, I_C = 4.33 × 10^{-40} $g.\ cm^2$, k = 1.3803 × 10^{-16} ergs K^{-1} and $\sigma = 3$)

(b) Discuss the effect of temperature on solubility of gases in solution.

The melting point of p-chlorobenzene is 53.2 °C and that of naphthalene is 80.2 °C. The eutectic temperature is 30.2 °C when mole fraction of naphthalene in liquid phase is 0.394. Calculate the molar heat of fusion of two components of the system assuming ideal behavior.

(c) Discuss chemical cell without transference in detail.

(d) Discuss in detail the elevation in boiling point of a dilute solution.
