Sl. No.	: **1911**
Unique Paper Code	: **42174306**
Name of the Paper	: **Physical Chemistry**
Name of Course	: **B. Sc. (Prog.) ACPM - CBCS**
Semester	: **III**

GC-3

Duration : **Three Hours**

Maximum Marks : 75

Attempt ***five*** questions in all

Q1. Answer ***any five*** questions in brief:

(a) Explain the state functions and path functions.

(b) What are Buffer Solutions? Define acidic and basic buffers with one example each.

(c) State Third Law of Thermodynamics. Explain its importance.

(d) Define specific conductance and equivalent conductance of an electrolytic solution.

(e) What is an azeotropic mixture? Give an example.

(f) Define pH of a solution. Calculate the pH of a solution having hydrogen ion concentration 2.5×10^{-3} M.

3x5

Q2. (a) State the Le Chatelier's Principle and predict the effect of temperature and pressure on the following:

$PCl_5\ (g) \rightleftharpoons PCl_3\ (g) + Cl_2\ (g)$ +Heat

$3H_2\ (g) + N_2\ (g) \rightleftharpoons 2NH_3\ (g)$ - Heat

(b) Define degree of ionization. Explain the factors affecting the degree of ionization.

(c) Calculate the degree of ionization and concentration of hydrogen ions of a 0.002 M acetic acid solution. The dissociation constant of acetic acid is 1.8×10^{-5}.

5x3

Q3. (a) Derive Henderson's equation to calculate the pH of an acidic buffer solution.

(b) Calculate the pH of a buffer solution containing 0.2 M CH_3COONa and 0.15 M of CH_3COOH. (K_a for CH_3COOH is 1.8×10^{-5}).

(c) State and explain Kohlrausch's Law of independent migration of ions. How can we calculate the molar conductance for Acetic acid using Kohlrausch's law?

5x3

Q4. (a) Draw the conductometric titration curve of

(i) strong acid Vs strong base (ii) weak acid Vs strong base

and explain the nature of the plot.

(b) What is a Calomel electrode? How can it be prepared? Write the electrochemical reactions taking place at a Calomel electrode.
(c) State Raoult's Law for vapour pressure of an ideal solution. Explain the positive and negative deviations from Raoult's law.

5x3

Q5. (a) Derive Gibbs - Helmholtz equation in terms of free energy and enthalpy change at constant pressure.
(b) Calculate the entropy change involved in the isothermal reversible expansion of 5 moles of an ideal gas from a volume of 10 litres to a volume of 100 litres at 300 K. (R= 8.314 $JK^{-1}mol^{-1}$)
(c) State Nernst distribution law and give conditions under which the law is valid.

5x3

Q6. (a) Define electrochemical series and give its applications.
(b) Can a solution of 1M $CuSO_4$ be stored in a vessel made of Nickel metal? Given that $E^{\circ}_{Ni, Ni^{2+}} = +0.25V$ and $E^{\circ}_{Cu, Cu^{2+}} = -0.34V$
(c) Explain Extensive and Intensive properties. Give examples for each.
(d) How does equivalent conductance vary with concentration for strong and weak electrolytes.

4,4,4,3

Q7. Write short notes on ***any three*** of the following:
(a) Statements of Second Law of Thermodynamics
(b) Standard Hydrogen Electrode
(c) Common Ion Effect
(d) Solvent Extraction
(e) Potentiometric Titrations (Acid-Base)

5x3