THE AMERICAN COLLEGE, MADURAI

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-accredited (2nd Cycle) by NAAC with Grade "A", CGPA – 3.46 on a 4-point scale

Backlog Arrear Examination, March, 2021

CHE 2516/ CHS 2516 | **PHYSICAL CHEMISTRY-III** | **Max: 75 mks, Time: 2 hrs**

SECTION A | **Answer ANY FIVE questions** | **(5 X 15 = 75)**

1. (a) Derive and explain Debye-Huckel limiting law. (10)
   (b) Calculate the ionic strength of a solution containing 0.2 molal K_2SO_4 and 0.1 molal KCl. (3)
   (c) Calculate the ionic mobility of Ag^+. The molar ionic conductance at infinite dilution at 25° C is 61.92×10^{-4} Sm^2 mol^{-1} (2)

2. (a) Explain corrosion and inhibition of corrosion. (5)
   (b) What are electrolyte concentration cells? Discuss concentration cell with transfer. (2+8)

3. (a) What are the differences between order and molecularity? (3)
   (b) Derive Eyring equation. (6)
   (c) Explain any two methods to determine the order of a reaction. (4)
   (d) Calculate the activation energy of a reaction whose rate constant is tripled by a 10°C rise in temperature in the vicinity of 27°C. (2)

4. (a) Derive Bronsted – Bjerrum equation. (7)
   (b) What are the characteristics of enzyme catalysis. (5)
   (c) Write short notes on: (i) negative catalysis (ii) autocatalysis. (3)

5. (a) Define buffer. Derive Henderson's equation to calculate pH of a buffer solution. (4)
   (b) Obtain degree of hydrolysis for the salt of strong acid and weak base. (3)
   (c) Illustrate the application of concept of solubility product in the following operations:
   i) Determination of solubility of sparingly soluble salts ii) salting out of soap. (3.5+3.5)
   (d) Calculate hydrogen ion concentration of a solution whose pH is 5.4. (1)

6. (a) List down the various applications of EMF measurements. (2)
   (b) For Fe, Fe^{2+} (0.1M) I Cd^{2+} (0.001 M), Cd ($E^o_{Cd2+/Cd} = -0.40$ & $E^o_{Fe2+/Fe} = -0.44$ at 25°C) write the cell reaction and calculate E^o and *K* for the above cell. (5)
   (c) Calculate the pH before and after the addition of 0.01 mole of NaOH to 1 litre of a buffer solution that is 0.1 M in acetic acid and 0.1 M in sodium acetate. The dissociation constant of acetic acid at room temperature is 1.75×10^{-5}. (5)
   (d) Derive integrated Arrhenius equation. (3)

7. (a) What is titration curve? Draw it. Explain the same for the titration of strong acid against strong base. (6)
   (b) Calculate the pH & pOH of an aqueous solution obtained by mixing 25 ml of 0.2 M HCl with 50 ml of 0.25 M NaOH. $K_w = 10^{-14}$ mol^2 dm^{-6} at 25°C. (5)
   (c) For the first order reaction at 130°C, the E_a is 108.4 kJ mol^{-1} and the rate constant is $9.12X10^{-4}$ s^{-1}. Calculate $(\Delta S^o)^{\#}$. (4)

****