# B.M.S. COLLEGE FOR WOMEN, AUTONOMOUS
## BENGALURU-560004
## SEMESTER END EXAMINATION-SEPT/OCT-2023

## M.Sc. in Chemistry-2nd Semester

## PHYSICAL CHEMISTRY-II

**Course Code: MCH203T**                                          **QP Code: 12009**
**Duration: 3 Hours**                                             **Max.Marks:70**

*Instruction: Answer Question No. 1 and any FIVE of the remaining.*

**1. Answer any *TEN* questions**                                 **(2X10 =20)**

  a)  State phase rule and explain the term involved.

  b)  Partition function is a temperature dependent. Justify using relevant equation.

  c)  Explain the canonical and grand canonical ensembles.

  d)  Indicate for each of the following particles, whether it is a fermion or boson.
      $^{14}N$, $^{4}He$, $^{19}F$, $^{+}D$

  e)  What is the thermodynamic criteria for non-equilibrium states?

  f)  How are flux and force of irreversible reaction related?

  g)  Write the Debye-Huckel equation for appreciable concentration and comment on the
      constants A and B

  h)  Calculate mean activity coefficient of 0.005 molal aqueous solution of $BaCl_2$ at 25 $^{0}C$

  i)  Justify the statement "The thickness of the ionic atmosphere decreases with increasing
      concentration".

  j)  Give the essence of the double layer at semiconductor-solution interface.

  k)  Sketch the plarogram of a solution containing two different metal ions. Comment on
      the useful of polarogram for the analysis of metal ion solution.

  l)  List out the failures of stern model.


 **2.** a) Comment on molecular partition function. Calculate the transitional partition function
       for benzene (molar mass =78 g/mol) in a volume of 2 $cm^3$ at 30 $^{0}C$.

   b) Sketch the phase diagram of $CH_3COOH$-$CHCl_3$-$H_2O$ and discuss the application of
      the phase rule to this system.                               **(5+ 5=10)**

 **3.** a) Show that affinity is a driving force for the entropy production in a chemical reaction.

b) Obtain an expression for the Fermi-Dirac statistical distribution. **(5+ 5=10)**

**4.** a) Explain the thermodynamic aspects of electrified interface.

b) Deduce an expression for the ionic atmosphere. **(5+ 5=10)**

**5.** a) Define the term limiting current and half wave potential. How are they useful for the detection and estimation of the concentration of metal ions?

b) Describe the quantum aspect of charge transfer at electrode solution interface. **(5+ 5=10)**

**6.** a) What is activity coefficient? Explain the emf method in the determination of activity coefficient.

b) Write a note on electrokinetic phenomena.

c) Summarize the relaxation effect and electrophoretic effect**. (4+3+3=10)**

**7.** a) Explain the term membrane electrode with a suitable example. Mention its applications.

b) Deduce an expression for rotational partition function.

c) Show that transformation properties of flux and force are the linear combination of affinities. **(4+3+3=10)**

**8.** a) Solve Debye-Huckel limiting law. Why it is called a limiting law?

b) Illustrate the various parameters influencing electrocatalysis.

c) Explain the intercept method in the determination of partial molar quantities.

**(4+3+3=10)**