PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2022
(First Semester)

Branch –   CHEMISTRY

THERMODYNAMICS, ELECTROCHEMISTRY AND PHASE EQUILIBRIUM

Time: Three Hours   Maximum: 50 Marks

SECTION-A (5 Marks)
Answer ALL questions
ALL questions carry EQUAL marks   (5 x 1 = 5)

1   The molal chemical potential is given by
(i)   dE/dS   (ii)   dE/dV
(iii) dE/dn   (iv) dE/dT

2   The C_p value at absolute zero temperature is
(i)   1   (ii)   0
(iii) R   (iv) 4.8

3   When increasing the dilution of an electrolyte, equivalent conductance will
(i)   Increase   (ii)   decrease
(iii) Increase then decrease   (iv) be 0

4   Helmholtz electrical double layer model predicts
(i)   constant capacitance   (ii) constant resistance
(iii) constant current   (iv) constant potential

5   Which equation relates the temperature, pressure, and the chemical potential of the components in a phase?
(i)   Gibbs phase equation   (ii)   Gibbs-Duhem equation
(iii) Nernst equation   (iv) Gibbs-Helmholtz equation

SECTION - B (15 Marks)
Answer ALL Questions
ALL Questions Carry EQUAL Marks   (5 x 3 = 15)

6   a   Derive expression for variations of chemical potential with pressure and temperature.
OR
b   Explain the determination of activity coefficient by EMF measurements method.

7   a   Write short note on Nernst heat theorem.
OR
b   Derive the Van't Hoff equation and its Integration form.

8   a   What are the types of electrodes? Give their Nernst equations.
OR
b   Derive the Henderson equation. How can we prepare pH 7.2 buffer solution using dihydrogen and mono hydrogen phosphate solution.

9   a   Explain the Helmholtz Parallel Plate double layer model.

OR

     b   How to derive the Zeta Potential in Electrophoresis?

10   a   Explain the sodium sulphate water system phase diagram.

OR

     b   Explain the terms simple eutectic, congruent and incongruent, melting systems with an example. What are the differences between congruent and incongruent melting point?

SECTION -C (30 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks   (5 x 6 = 30)

11   a   What is partial molar free energy? Derive the Gibbs-Duhem Equations.
     b   How is fugacity determined by graphical method?

OR

     c   Derive Duhem-Margules equation and mention its importance.
     d   What are the applications of chemical potential?

12   a   Derive thermodynamic expression for chemical equilibrium.

OR

     b   Explain the Le Chatelier-Braun principle and its applications to chemical equilibria.

13   a   Derive an expression for the thickness of an ionic atmosphere in strong electrolyte.

OR

     b   How can we measure the conductance of an electrolyte? Explain the various applications of conductance measurement.

14   a   Explain the Stern double layer model with its merits and demerits.

OR

     b   Derive Butler-Volmer equation and explain its uses.
     c   Enumerate the factors affecting the over-voltage.

15   a   Derive the Gibbs phase rule and explain the phase diagram of water.

OR

     b   Explain the Fe-C phase diagram and explain its importance in steel making.

Z-Z-Z   END