BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION (SUPPLEMENTARY), 2023

(SECOND YEAR FIRST SEMESTER)

Subject: Physical Chemistry

Full Marks – 100 **Time: 3 hours**

Use Separate Answer scripts for each Part

Part –I

1. **Answer any ten questions:** **3×10 = 30**

I. What is conductometric titration? What is the advantage of conductometric titration against indicator titration for acid-base titration?

II. Define molar conductance. What is its unit?

III. NaCl is soluble in H_2O but insoluble in CCl_4 – why?

IV. Draw the relation between activity and activity solubility product of sparingly soluble salts: (i) CaF_2 and (ii) $BaSO_4$.

V. What is meant by mean ionic activity co-efficient?

VI. Mention two applications of conductometric titrations.

VII. What is concentration polarization?

VIII. What are the factors that affect electrolytic conduction?

IX. State the difference decomposition potential and between overpotential.

X. Define contact angle.

XI. What are cationic surfactants? Give one example.

XII. What is water-in-oil microemulsion?

XIII. What is colloid?

XIV. How does water strider can walk on water surface?

XV. Write the unit and dimension of surface tension.

Part –II

Answer any seven questions: **10×7 = 70**

1. Give a brief account of the relaxation effect and electrophoretic effects in relation to Debye-Hückel theory of ionic atmosphere. **5+5=10**

2. Discuss the variation of the specific conductance with concentration and cell constants of an electrolyte solution. **6+4=10**

3. Draw a brief account of the relation between ionic conductance and ionic mobility of the cations and anions of an electrolyte solution? **5+5=10**

4. What is meant by cell potential? How is cell potential affected by concentration of the reactants? State the differences between primary and secondary cells with examples. **2+3+5=10**

5. (a) What is fuel cell? Discuss the advantage and disadvantages of fuel cell. **2+4=6**
   (b) Equal volumes of 0.08 (N) $CaCl_2$ and 0.02 (N) Na_2SO_4 are mixed at room temperature. Will there be any precipitation? Solubility product of $CaSO_4$ is 2.4×10^{-5} at the same temperature. **4**

6. Explain the conductometric titration curve of (i) HCl *vs.* NaOH and (ii) CH_3COOH vs. NH_4OH. **5+5=10**

7. What is meant by overvoltage or overpotential? On what factors, does the overpotential of an electrochemical cell depend? How can the overpotential be measured experimentally? **2+3+5=10**

8. Differentiate between micelle and reverse micelle. How does the entropy change in the process of micellization from surfactant monomer? **3+7=10**

9. What is metal nanoparticle? Describe the procedure for the synthesis of metal nanoparticle from reverse micellar templating. **3+7=10**

10. Define surface tension. Distinguish between surface tension and surface energy. Which are the forces behind the origin of surface tension? **2+3+5=10**

11. Why do surfactant molecules decrease the surface tension of water? Define critical micellar concentration (CMC). Describe any one method to measure CMC. **3+2+5=10**

12. Explain electrical double layer. Define zeta potential with diagram. **4+6=10**