SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN
(AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)
Chromepet, Chennai — 600 044.
M.Sc. - END SEMESTER EXAMINATIONS NOVEMBER - 2022
SEMESTER - III
20PCHET3003 - Electrochemistry

Total Duration : 2 Hrs 30 Mins.   **Total Marks : 60**

Section A

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. List out the postulates of Bjerrum ion pair theory and explain the modification of the Debye Huckel equation.

2. Explain the Helmholtz-Perin model and discuss the structure of the double layer with necessary diagram and equations.

3. Explain the working of hydrocarbon - oxygen fuel cell with a neat diagram.

4. Explain in detail any two of the following methods to control corrosion.
    i. Impressed current cathodic protection
    ii. Sacrificial anodic protection
    iii. Coatings
    iv. Inhibitors

5. Summarize on Fick's law of diffusion and its application.

6. At $25°C$ the exchange current density of $Pt/H_2(g)$ / H^+ (aq) electrode is 0.79 mA/cm^2. Calculate the current flowing through the standard electrode of area $5cm^2$ when the overpotential is 5mV.

7. With a neat sketch discuss in detail on the working of Quinhydrone electrode with its merits and demerits.

8. With a neat diagram infer the significance of Evan's diagram in corrosion.

Section B

Part A

Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. (i) Give the Debye Huckel equations for the mean activity
    coefficient of electrolytes and explain its experimental validation.
    (ii) Calculate the value of ionic strength and mean activity coefficient in
    5.0×10^{-2} molal solutions of (a) KCl (b) $Ca(NO_3)_2$(c) $ZnSO_4$. Assume complete dissociation.

Contd...

10. Deduce the Debye-Huckel-Onsagar equation.

11. Determine the kinetics of single step one electron-transfer electrode reaction and examine the Butler-Volmer equation for
    i) high overvoltage ii) Low overvoltage values.

12. Explain the construction, charging and discharging reactions involved in lead - acid battery.

Part B

Compulsory question $(1 \times 10 = 10 \text{ Marks})$

13. Assess the corrosion behavior of Iron water system using Pourbiax diagram.

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