

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7263

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Unique Paper Code : 2173550013

Name of the Paper : DSE: INTERFACIAL ELECTROCHEMISTRY

Name of the Course : **B.Sc. (Hons.)**

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **FOUR** questions in all.

1. (a) Derive the given equation, where symbols have their usual meaning

$$i = i_0 \left\{ e^{\frac{(1-\alpha)\eta F}{RT}} - e^{\frac{-\alpha\eta F}{RT}} \right\}$$

- (b) How the value of transfer coefficient and exchange current density can be determined from the Tafel plot. Calculate the value of transfer coefficient if slope of a Tafel plot is 0.291 V/decade.
 - (c) How the plot of current density versus overpotential changes with change in the value of transfer coefficient? (7,5,3)
2.
 - (a) How do different types of overpotential arise and what factors influence them in electrochemical systems?
 - (b) Describe the principle of cyclic voltammetry. Draw a typical cyclic voltammogram showing peak current, peak potential, and switching potential.
 - (c) Define the terms: Diffusion, Diffusion coefficient and Diffusion flux. What factors influence the diffusion coefficient? (5,5,5)

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3. (a) Answer the followings :
- (i) Lippmann equation of electrocapillary
 - (ii) Debye-Huckel-Onsager equation
 - (iii) Gouy-Chapman equation
- (b) Discuss how Grahame modified the Stern's model of electrical double layer and then, discuss the Watts-Tobin Model.
- (c) What is an electrocatalyst? Give an example. Discuss the role of electrode material in electrochemical water splitting. (6,5,4)
4. (a) Explain the working of an alkaline fuel cell with electrode reactions and diagram. State its advantages.
- (b) Discuss the energy profile diagram of electron transfer according to Marcus Theory.
- (c) Explain relaxation effect and define relaxation time in electrolyte solutions. (7,4,4)
5. (a) Explain corrosion with examples. Describe the electrochemical mechanism of rusting of iron.
- (b) What are corrosion inhibitors? Discuss their types and examples.
- (c) Explain the working of an Electric Double Layer Capacitor with its charge storage mechanism. (5,5,5)
6. Explain the following :
- (a) Li-ion batteries
 - (b) Waterline and crevice corrosion
 - (c) Vanadium redox flow batteries (5,5,5)