



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. in Applied Sciences
Third Year - Semester I Examination – July / August 2023

CHE 3207 – ELECTROCHEMISTRY

Time: Two (02) hours

Answer all questions.

Use of a non-programmable calculator is permitted.

1. a) Explain the following:
 - i. Overpotential
 - ii. Mass-transfer controlled reaction
 (20 marks)
- b) Draw a labeled free activation energy diagram for a metal in a solution with its own ions under the following conditions.
 - i. At equilibrium
 - ii. More negative overpotential
 (20 marks)
- c) Explain the corrosion of iron by dilute mineral acids with necessary reactions under aerobic conditions with suitable potential-current curves. Define corrosion current and corrosion potential. (30 marks)
- d) Explain the passivation of corrosion of iron with completely labeled corrosion current-potential diagram. Identify the different regions in your diagram. (30 marks)
2. a) Draw a completely labeled Pourbaix diagram involving oxygen and hydrogen evolution for a zinc-water system. Show the effect of potential for increasing the concentration of Zn^{2+} from 0.1 mol dm^{-3} to 1.0 mol dm^{-3} in the diagram. $E^0 (\text{Zn}^{2+}/\text{Zn}) = -0.76 \text{ V}$. (50 marks)
- b) What is the principle of cathodic protection? Explain the protection given to underground pipeline by impressed current method using a potential-current diagram (50 marks)
3. a) The electrochemical pathway is advantageous in many ways over the traditional pathway in organic synthesis. Comment.
- b) Discuss the electrochemical cell design and modes of operation in electroorganic synthesis.
- c) Outline the electrochemical synthesis of NCCH_2COOH using CO_2 and CH_3CN as substrates.
- d) Ionic liquids have merits over traditional organic solvents. Explain.

(Each part carries equal marks of 25)

4. a) Give a comparative account of the operational mechanism of a fuel cell, a battery and a super capacitor with suitable diagrams.
- b) Why electrocoagulation has become a promising technology in water treatment? Discuss the mechanism involved in the removal of hardness in water.

(Each part carries equal marks of 50)

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