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GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

Ph.D. (First Semester-Winter) Examinations, June – 2025

23WPPECH1021 – ELECTROCHEMISTRY

(Chemical)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

	Answer *ANY FIVE* Questions. (14 x 5 = 70 Marks)	**Marks**
1.a.	Discuss the steps involved in a general electrochemical reaction mechanism.	8
b.	How can techniques like cyclic voltammetry be used to investigate these mechanisms?	6
2.	Discuss the steps involved in a general electrochemical reaction mechanism. How can techniques like cyclic voltammetry be used to investigate these mechanisms?	14
3.a.	Explain the working principle of cyclic voltammetry. How is it used to study the reversibility and kinetics of redox reactions?	7
b.	Explain the principle and working of a rotating disk electrode. How is the Levich equation derived and what does it signify?	7
4.	What are super capacitors? Describe their types (EDLCs and pseudo capacitors), charge storage mechanisms, and materials used. How do hybrid energy storage systems combine the advantages of batteries and super capacitors?	14
5.a.	Explain the working principles of Proton Exchange Membrane Fuel Cells (PEMFC), Solid Oxide Fuel Cells (SOFC).	7
b.	Discuss the major challenges and future prospects for Na-ion batteries as a sustainable alternative to Li-ion technology.	7
6.a.	Describe the industrial-scale chlor-alkali process. Explain the reactions at the anode and cathode, the role of the membrane or diaphragm, and the overall process design.	7
b.	Describe various techniques such as electro coagulation, electro oxidation, and electro-Fenton processes.	7
7.	What is photo-electrochemistry? Discuss the principles of photo electrochemical water splitting and the materials used for photo anodes and photocathode. How does this technique contribute to solar energy conversion and hydrogen generation?	14
8.a.	Discuss the integration of machine learning (ML) in computational electrochemistry	7
b.	Discuss the challenges in multiscale modelling, data sharing, and real-time simulation for energy storage and conversion systems.	7

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