Course Type	Course Code	Name of the Course	L	T	P	Credits
DE	CHD418	Electrochemical Science and Engineering	3	0	0	9

Course Objective
The objectives of this course are to study the theoretical and applied aspects of electrochemical science and engineering.
Learning Outcomes
At the end of the course, the students would be able to understand the basic fundamentals of electrochemical science and engineering and different evaluation and testing techniques. The thermodynamics and kinetics of electrode operation will help students to correlate the chemical engineering aspects of the electrochemical systems.

Unit No.	Topic to be covered	Lecture Hours	Learning Outcome
1	**Introduction:** Introduction to electrochemistry and examples of electrochemical systems, electrochemical cells and reactions, non-Faradic processes, electrode-solution interface, and double layer capacitance, conductance, transference and mobility, electrochemical physics.	**09**	The students will be able to know the fundamentals of electrochemical science-chemistry and physics.
2	**Thermodynamics and kinetics of the electrode reactions:** Thermodynamics of electrochemical systems, cell potentials, liquid junction potentials etc., mechanisms of electrochemical reactions, kinetics of electrode reactions, Butler-Volmer model and microscopic theories for charge transfer, different electrochemical measurements techniques.	**13**	The students will have understanding of the thermodynamics, kinetics and mechanism of electrochemical reactions.
3	**Mass transfer:** Factors affecting rates of electrode reactions (mass transfer controlled reactions and coupled chemical reactions), mass transfer by migration and diffusion.	**09**	The students will learn mass transfer aspects and controlling mechanisms.
4	**Industrial Application:** Bulk electrolysis and industrial application of electrochemical, electrocatalysis, energy storage devices, electrochemical reactor and electro coalescence, scale-up of electrochemical systems.	**11**	The students will have exposure of industrial applications and scale up methods of electrochemical systems.

Textbooks:

1. Bard, A. J. and Faulkner, L. R. (2000). Electrochemical Methods: Fundamentals and Applications, 2nd Ed.; Wiley: New York.
2. Rieger, P. H. (1994). Electrochemistry; Springer.

Reference Books:

1. Newman, J. S. and Thomas-Alyea, K. E. Electrochemical systems; Wiley-Interscience, 2004.
2. Bockris, J. O., Reddy, A. K. N. and Gamboa-Aldeco, M. (2000). Modern electrochemistry. Vol.1-2; Kluwer Academic/Plenum Publishers: New York.