CH-427 Electrochemistry

Credit Hours: 3-0

Prerequisite: Nil

Course Objectives

The students will learn the fundamentals principles of electrochemistry to the advanced level for their deplyment in the specific areas like electrochemical cells, electrochemical sensors, development of electrodes and their efficient working.

Course Contents:

Electrochemistry: An introduction to electrochemistry, chemical reactions and redox potentials, conductors, semiconductors, insulators, types of cells, electrolysis, Faraday s Law of Electrolysis, Ohm s Law, electrolytic conductance, equivalent and molar conductance, electrochemical cells and types of electrodes. Nernst s equation and its application.

Predicting reactions, stability of oxidation states, cell potential and thermodynamics. Theory of metallic conduction. Electrode potential, liquid junction potential, transference number. Ions in aqueous solution. Potentiometry: Activity, Debye-Hückel theory of ion-ion interactions, Limiting Debye-Hückel theory, Influence of the ionic radius, Electrode potentials. Properties of the electrode-solution interface: Interface electrode-solution, Type of the electrodes, The electrochemical potential, Internal, external, and surface potentials, Distribution of energy levels, Two metals in contact, Metal-solution interface, Absolute electrode potential, Absolute potential of the standard hydrogen electrode. Electrode Kinetics; Kinetics of electron transfer, Current over-potential relation, Butler-Volmer equation. Applications: batteries, fuel cells.

Recommended Books

1. Andrzej Lasia, Advanced Electrochemistry. Interfaces, thermodynamics, and electrochemical techniques, Jan. (2018)
2. Atkins, P. and Paula, J. D., Atkin s Physical Chemistry, 9th ed., Oxford University Press, (2010).
3. Bard, A. J. and Faulkner, L. R., *Electrochemical Method*:*Fundamentals and Applications*

2nd ed., John-Wiley & Sons, New York, (2001).

4. Hamann,C.H., Hamnett,A. and Veilstich,W., *Electrochemistry,* 2nd ed., Wiley-VCHVerla Gnb H and Co.KGaA, (2007).