SS836 ELECTRO AND PHOTO CATALYTIC MATERIALS 3-1-0-4

Unit 1: **Basics of Electrochemistry**

Electrochemical cells: Galvanic cell. Half reactions and reversible electrodes: metalmetal ion lectrodes, Gas electrodes – hydrogen electrode, oxygen electrode, oxygen electrode, Metal – insoluble metal salt electrodes – calomel electrode, oxidation – reduction electrode. Over potential. Butler – Volmer equation. The Nernst equation.

Concentration cells: Electrode concentration cells, Electrolyte concentration cells. Ion –solvent interaction. Ion transport. Debye – Huckel treatment. Onsagar equation.

Unit 2: **Catalysis**

Theories of catalysis: Intermediate compound formation theory of catalysis, Adsorption theory of catalysis. Heterogeneous catalysis: classic gas/solid system, the concept of the active site, promoters, modifiers and poisons. Homogeneous catalysis: elementary steps in homogeneous catalysis, ligand exchange, oxidative addition, reductive elimination, insertion and migration, de-insertion and beta –elimination, nucleophilic attack on a coordination site, industrial examples: Wacker oxidation process.

Unit 3: **Hydrogen evolution**

Sustainable energy source; renewable energy, hydrogen energy economy, hydrogen production, methods of hydrogen storage, hydrogen as an engine fuel. Hydrogen evolution:,Electrocatalytic and photocatalytic water splitting. Properties of electro/photocatalytic materials. Role of cocatalyst in hydrogen evolving reaction.

Advantages of electro/photo catalyst in hydrogen evolution. Difficulties in the development of electro and photocatalyst.

Unit: 4: **Materials and its characterization**

Doping with metals- nonmetals as modifiers. Dye sensitized Titania, Coupled semiconductors, conducting polymers as dopant, Supported Titania catalysts. Advanced techniques used in electrocatalysis: Electrochemical impedance analyzer-principle, OCP measurement, UV Visible spectro photometer, Photo simulator. GC analysis for hydrogen evolution rate.

Unit5: Advanced electrochemical methods

Principle and applications of potentio dynamic polarization. Electrochemical impedance analysis : principle, applications, Nyquist and Bode plots, Different circuit used in impedance analysis. Principle of cyclic voltametry. Linear sweep voltametry – linear potential wave form.

TEXT BOOKS/ REFERENCES:

1. J.O.M. Bokris and A.K.N. Reddy “Modern Electrochemistry”, Plenum.
2. D.R.Crow “Principles and Applications of Electrochemistry” S. Thomes.
3. Hans-Jurgen Butt, Karlheinz Graf, Michael Kappl ;Physics and Chemistry of interfaces,Wiley-VCH Verlag Gmbh & Co.
4. Leite, Edson Roberto; Nano Structured Materials for Electrochemical Energy
5. R.de Levie, P.Delahay, Adv.Electrochem.Eng, Vol-6, Inter science, 1967. Production and Storage-2009
6. Antoni Llobet, “Molecular water oxidation catalysis”, Wiley