



MANGALORE UNIVERSITY

DEPARTMENT OF CHEMISTRY

M.Sc. APPLIED CHEMISTRY

AC S 555: APPLIED ELECTROCHEMISTRY

COURSE OUTCOME:

- The course covers important practical applications of electrochemistry. Batteries, fuel cells, sensors and electroplating techniques are dealt with.
- The use of electrochemical techniques in environmental related issues are discussed
- chemical processes such as costing and design of electrochemical processes,
- They can learn important organic and inorganic reactions which can be carried out in industries and modern technological developments in electrochemical industrial processes.

UNIT-I:

[1 Hour]

Electrochemical Energy System: Electricity storage-Importance, storage density, Fundamentals and classification of batteries, Primary battery (Laclanche-dry cell and Alkaline cell). Secondary battery (acid and alkaline). Reserve batteries. Lithium batteries - (primary and secondary and lithium based conducting polymer battery). Fuel cells – introduction, classification, H₂-O₂ and bio-cells.

5hrs

Bio-electrochemistry- Introduction, Membrane potential - theoretical and modern approach. Electrical conduction in biological organism, Electrochemical communication in biological organisms.

3hrs

Sensors: Biosensors: Introduction electrochemical bio-sensors- characteristics, use as a transducer, types. **Ion-Sensors:** Ion-selective electrode: Introduction, Types. Analytical and biological applications of sensors.

4hrs

UNIT-II:

[12 Hours]

Metallurgical Processing: Electroplating-fundamentals, mechanism of electrodeposition of metals, application of electroplating. Brief account of Electroless plating, Conversion coatings, Electrophoretic painting

Metals and materials processing-theory and applications of Electroforming and Electrochemical etching. Production of metals by electro winning and electrorefining. **Electrochemistry of Environment:** Introduction, Global warming. Electrochemistry in - transport system, fixing of CO₂, sewage disposal, treatment of waste, Metal ion removal and metal recovery. Treatment of liquors containing dissolved chromium.

UNIT-III:

[12 Hours]

Electrochemical Engineering: General considerations, costing and technology of electrolytic process, electrolysis parameters, principles of cell design, laboratory data and scale-up, performance and figures of merit. **4hrs**

Industrial Electrochemistry: Fundamentals, electro- organic synthesis (Kolbes synthesis, oxidation and reduction of hydrocarbons, reduction of nitro-compounds); Electro inorganic synthesis of fluorine and ozone. Synthesis of metal salts via anodic dissolution **4hrs.**

Industrial Application- A Case study:- The chlor-alkaly industry: Introduction, General concepts of brine electrolysis, modern technological developments (electrode materials, membrane), chlorine cell technologies (diaphragm cells, membrane cell). **4hrs**

References:

1. Modern Electrochemistry, 2nd Ed. Vol.1,2A &2B, Bockris& Reddy (Plenum, NY) 1998
2. Chemical &Electrochemical Energy Systems, R. Narayan & B. Viswanathan (University Press), 1998.
3. Industrial Electrochemistry, D. Peltcher& F. C. Walsh (Chapman & Hall)1990.
4. 4. Biosensors-theory and Applications, Donald G. Burek, (Technomic), 1993
5. Principles and Applications of Electrochemistry–Crow (Chapman hall, New York) 2014
6. Fundamentals of Electrochemistry, Fulkner and A. J. Bard, Wiley India, 2006.