

## DEPARTMENT OF CHEMISTRY

### Engineering Chemistry- I (CH110)

2019-20

I semester B.E.  
Syllabus for circuit branches

Sub code: CH 110  
Credits: 3:0:1  
Total hours: 52 hrs

#### UNIT-I

##### ELECTROCHEMISTRY

Introduction, Single electrode potential – definition, origin, sign conventions, standard electrode potential. Derivation of Nernst equation for single electrode potential. EMF of a cell- definition, notation and convention. Numerical problems. Reference electrodes – calomel electrode & Ag/AgCl electrode. Concentration cells – definition, construction and working. Ion selective electrode – glass electrode, determination of pH using glass electrode.

##### ELECTROPLATING AND ELECTROLESS PLATING

Importance, significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroplating process: Effects of variables on the nature of electro deposit – current density, metal ion concentration, temperature, pH of the bath, additives – brighteners, levellers, structure modifier and wetting agents, throwing power of the bath. Surface preparation – by using solvents, alkali, acid and electropolishing, Electroplating of Cr and Ni. Electroless plating – Differences between electroplating and electroless plating, advantages of electroless plating, electroless plating of copper on PCB.

12 hrs

#### UNIT – II

##### CORROSION SCIENCE

Corrosion- definition, types-chemical and electrochemical corrosion. Electrochemical theory of corrosion, Factors affecting the rate of corrosion-nature of metal, nature of corrosion product, relative areas of anode and cathode, temperature and pH. Types of corrosion – differential metal

corrosion, differential aeration corrosion (pitting and waterline corrosion), stress corrosion-caustic embrittlement in boilers.

Corrosion control – Metal coating- galvanizing and tinning. Inorganic coatings-anodizing and phosphating, Corrosion inhibitors- anodic and cathodic. Cathodic protection- sacrificial anode and impressed current techniques, Anodic protection.

8 hrs

### **UNIT – III**

#### **CHEMISTRY AND APPLICATIONS OF POLYMERS**

Polymers – Introduction, Thermoplastics and thermosetting plastics with examples, weight average and number average molecular weight, Numerical problems. Glass transition temperature (T<sub>g</sub>) – parameters affecting T<sub>g</sub> and significance of T<sub>g</sub>. Synthesis, properties and applications of PTFE, PMMA and PU.

Adhesives– definition, synthesis, properties and applications of epoxy resin.

Elastomers – definition, deficiencies of natural rubber, advantages of synthetic rubber. Synthesis and applications of neoprene and butyl rubber.

Biodegradable polymers - Introduction and their requirements. Synthesis and properties of polylactic acid, Applications of biodegradable polymers in medical industry.

Conducting polymers – definition and mechanism of conduction in polyacetylene.

Photoconducting polymers – Synthesis of Poly vinyl carbazole and its applications in laser printing.

11 hrs

### **UNIT – IV**

#### **WATER CHEMISTRY**

Introduction, hardness - types, units of hardness. Determination of hardness of water by EDTA method. Numerical problems. Water analysis – estimation of chloride, fluoride and nitrate. Determination of DO by winkler's method. Bio-chemical oxygen Demand and Chemical Oxygen Demand. Numerical problems on BOD and COD. Desalination of water – electro dialysis and reverse osmosis.

#### **CHEMISTRY OF NANOMATERIALS**

Introduction, Definition, classification of nanomaterials based on dimensions. General properties of nanomaterials, Synthesis of nanomaterials – top down and bottom up approach-methods –sol gel method and chemical vapour deposition method.Applications of nanomaterials.

11 hrs

## UNIT –V

### BATTERY TECHNOLOGY

Introduction, definition , battery characteristics, classification – primary, secondary and reserve batteries with examples. Modern batteries-construction, working and applications of Nickel-Metal hydride, Lithium-MnO<sub>2</sub> and Li-ion batteries.

### RENEWABLE SOURCES OF ENERGY

Introduction, Importance of solar (PV) cells, Photovoltaic cell, the p-n junction of a solar cell. Working of solar cell. Doping of silicon for photovoltaic cells and chemical properties for solar grade silicon. Production of solar grade silicon from quartz. Dye sensitized solar cells.

### SUPER CAPACITORS

Introduction, Types of supercapacitors: Electrochemical Double-Layer Capacitors-activated carbons, carbon nanotubes (CNT) and aerogels. Psuedocapacitors-conducting polymers and metal oxides. Advantages, Limitations and Applications.

10 hrs

#### Reference Books:

1. A text book of Engineering Chemistry by Jain and Jain, Dhanapatrai Publications, New Delhi.
2. Engineering Chemistry by Uppal, Khanna Publishers, Sixth Edition, 2001.
3. Principles of Physical Chemistry by B.R. Puri, L.R.Sharma & M.S. Pathania, S.Nagin Chand and Co., 33<sup>rd</sup> Ed., 1992.
4. A text book of Physical Chemistry by P.L.Soni and O.P.Dharma.
5. A text book of Polymer science by V.R. Gowarikar & others New-age publications.
6. Corrosion Engineering-by M. G. Fontana, McGraw Hill Publications.
7. Text book of Polymer science by F.W.Billmeyer, John, Wiley and Sons, 1994.
8. Environmental chemistry by Stanley E. Manahan, 7<sup>th</sup> edition, Lewis publishers, 2000.
9. Hand book of Nanotechnology, BharathBhushan, Spinger-Verlag Berlin Heidelberg New York.2004.