ENGINEERING CHEMISTRY
SYLLABUS FOR THE YEAR 2011– 2014

Sub Code: 11CY1ICCHY / 11CY2ICCHY **L-T-P: 4-0-1**

Credits : 05 **Hours / Week: 06**

Learning Objectives: The students will learn the following:

The three main issues while dealing with energy problems:

i) The need to restrict increase in energy consumption ii) The need to evolve alternative energy sources as a substitute to conventional energy sources. iii) The evolution of how far these new energy sources can serve as replacement for conventional energy sources.

The process involved in the interconversion of electrical energy and chemical energy.

The idea of deterioration of metal / alloy due to electrochemical interaction of metal / alloy with its environment, ill effects of corrosion, types and corrosion control by various methods.

Information about better things for better living - through polymers.

The instrumental methods of analysis are now being extensively used for the qualitative analysis and identification of organic compounds.

Learning Outcomes: After the completion of the course, students will have acquired:

Pros and cons of using fossil fuels as energy sources, development of alternative sources of energy like synthetic petrol, power alcohol, biodiesel, solar cells, etc.

Better understanding of electro chemistry, different types of batteries, fuel cells and their applications in transportation, in the defense sector, for communication systems, radio sector, emergency signals, detonators, submarines and space crafts, utility items like flash lights, wrist-watches, tape recorders, photo flash devises, hearing aids, pace makers, etc.

Technological information about corrosion, corrosion control by galvanization, tinning, electroplating methods and electroless plating in developing printed circuit boards.

Synthesis of polymers like plastics, rubbers, fibers, adhesives, composites and conducting polymers which find immense applications in engineering field.

Foundation needed to understand the principles of various analytical technics like conductometry, colorimetry, potentiometry, flame- photometry, thin layer chromatography and their applications.

Unit – I : Chemical Energy Sources

Fuels - definition, classification, calorific value-definition, gross and net calorific values, determination of calorific value of a solid/ liquid fuel using Bomb calorimeter and problems on calorific value, petroleum cracking - fluidized bed catalytic cracking, reformation of petrol, octane number, cetane number, knocking – mechanism, prevention of knocking, anti-knocking agents, unleaded petrol, synthetic petrol – Fischer-Tropsch's process, power alcohol and biodiesel.

Solar Energy – introduction, photovoltaic cell-definition, importance, working of a PVcell, solar grade silicon, physical and chemical properties of silicon relevant to photovoltaics, production of solar grade (crystalline) silicon, doping of silicon.

10 hours

Unit – II: Electrochemical Energy Systems

Electrode potential and cells - single electrode potential - definition, origin, sign conventions, derivation of Nernst equation, standard electrode potential -definition. classification - primary, secondary and concentration cells, reference electrodes – calomel electrode, numerical problems on electrode potential and cell potential, ion-selective electrode- glass electrode, determination of pH using glass electrode.

Batteries - basic concepts, battery characteristics, classification of batteries– primary, secondary and reserve batteries,classical batteries – construction, working and applications of lead –acid battery and nickel–cadmium battery, modern batteries - construction, working and applications of zinc–air, nickel-metal hydride and Li-MnO_2 batteries.

Fuel cells - introduction, types of fuel cells - alkaline, phosphoric acid, molten carbonate, solid polymer electrolyte and solid oxide fuel cells, construction and working of H_2-O_2 fuel cell.

10 hours

Unit – III: Corrosion Science and Metal Finishing

Corrosion – definition of chemical corrosion, electrochemical theory of corrosion, types of corrosion - differential aeration corrosion (pitting and water line corrosion), stress corrosion, factor affecting the rate of corrosion.
Corrosion control: inorganic coatings – anodizing and phosphating, metal coatings – galvanization and tinning, corrosion inhibitors, cathodic protection.
Metal finishing - technological importance of metal finishing, significance of polarization, decomposition potential and over-voltage in electroplating processes.
Electroplating – process, effect of plating variables on the nature of electro-deposit, surface preparation, electroplating of Cr and Au.
Electroless plating - distinction between electroplating and electoless plating, advantages of electroless plating, electroless plating of copper on PCB.

11 hours

Unit-IV : High Polymers

Polymers - definition, classification, types of polymerization - addition and condensation with examples, mechanism of polymerization - free radical mechanism (ethylene as an example), methods of polymerization – bulk, solution, suspension and emulsion polymerization, glass transition temperature, structure and property relationship of polymers.

Plastics- synthesis, properties and applications of teflon, PMMA and phenol – formaldehyde resin.

Elastomers -synthesis and application of neoprene and butyl rubber.

Adhesives - preparation and applications of epoxy resins.

Polymer composites.

Conducting polymers – definition, structure and mechanism, properties and applications of polyacetyalene.

11 hours

Unit-V : Phase Rule and Instrumental Methods of Analysis

Phase rule-definition , terms involved in phase rule, water system and Pb–Ag system.

Instrumental methods of analysis : introduction, types of instrumental methods of analysis – conductometry, potentiometry, colorimetry and flame photometry.

Chromatography - introduction to chromatography, details of thin layer chromatography.

10 Hours

Text Books

1. A Text book of Engineering Chemistry – by Jain and Jain, Dhanapatrai Publications, New Delhi.
2. Engineering Chemistry by Dr. S Satyanarayana and H C Shashidhara
3. Engineering Chemistry by Gadag and Nityananda Shetty
4. Engineering Chemistry by Jai Prakash and others.

Reference Books

1. Principles of Physical Chemistry B.R. Puri, L.R.Sharma and M.S Pathania, S.Nagin
2. Text book of Polymer Science by F.W.Billmeyer, John Wiley and Sons 1994. Horwood series in Physical Chemistry, New York. (P. No. 106 – 142)
3. Corrosion Engineering – by M G Fontana, Mc Graw Hill Publications.
4. Advanced Chemistry by Philip Mathews
5. Text book of polymer Science by Gowrikar
6. Elements of Spectroscopy by William Kemp
7. Instrumental methods of analysis by Skoog and West
8. Instrumental methods of analysis by Chatwal and Anand
9. Chemistry for Engineers – Vol I & II by Kuriacose and Rajaram
10. Introduction to Molecular Spectroscopy by Banwell

ENGINEERING CHEMISTRY LABORATORY

SYLLABUS for the year 2012-2013

LIST OF EXPERIMENTS

PART – A

1. Determination of total hardness of a sample of water using disodium salt of EDTA.
2. Determination of percentage of copper in brass using standard sodium thiosulphate solution.
3. Determination of iron in the given sample of haematite ore solution (using potassium dichromate) by external indicator method.
4. Determination of chemical oxygen demand (COD) of the given industrial waste water sample.

PART – B

1. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Colorimetric determination of copper.
3. Colorimetric determination of iron.
4. Conductometric estimation of HCl using standard NaOH solution.
5. Determination of R_f value of a compound by thin-layer chromatography
6. Determination of pka of a weak acid using pH meter.
7. Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.