

JSS Mahavidyapeetha
Sri Jayachamarajendra College of Engineering, Mysore-570 006
(Autonomous Institution affiliated to VTU, Belgaum)

Department : Chemistry

Subject: Engineering Chemistry

I/II semester B.E. Common for all branches
Syllabus from the Academic year 2016-2017

Sub code: CH 110/210

Credits: 4

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. Electrochemical cells- Classification-Electrolytic cells and galvanic cells. Construction of galvanic cell. EMF of a cell- definition, notation and conventions. Measurement of single electrode potential (Poggendorf's method). Electrodes – Types-Reference electrodes – calomel electrode & Ag/AgCl electrode. Concentration cells – definition, construction and working. Ion selective electrode – glass electrode, determination of pH using glass electrode.

BATTERY TECHNOLOGY

Introduction, definition, battery characteristics, classification – primary, secondary and reserve with examples. Modern batteries-construction, working and applications of Nickel-Metal hydride, Nickel-Cadmium Lithium-MnO₂ and Li-ion batteries.

FUEL CELLS

Introduction, Classification, Construction and working of H₂-O₂ and methanol-oxygen fuel cells.

12hrs

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

ELECTROPLATING AND ELECTROLESS PLATING

Importance, significance of polarisation, decomposition potential and over-voltage in electroplating processes. Electroplating process: Effects of variables on the nature of electro deposit – current density, metal salt and electrolyte concentration, metal ion concentration, temperature, pH of the bath, additives – brighteners, levelers, 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.

12hrs

UNIT –III ENERGY SOURCES

Chemical Fuels- Definition, classification; calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid/liquid fuel using Bomb calorimeter, numerical problems, Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. Knocking and its mechanism, octane number, cetane number, prevention of knocking, anti-knocking agents, unleaded petrol.

INSTRUMENTAL METHODS OF ANALYSIS

Introduction, advantages over conventional methods. Principle, theory and applications of Colorimetry, Potentiometry and Conductometry.

9hrs

UNIT-IV WATER CHEMISTRY

Introduction, hardness - types, units of hardness. Determination of hardness of water by EDTA method. 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-0D spheres and clusters, 1D Nano fibres, wires and rods (multilayers), 2D films, plates and networks, (Ultrafine-grained overlayers), 3D nanomaterials. 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 and nanotechnology.

10hrs

UNIT-V

HIGH POLYMERS

Polymers-classification (natural and synthetic) with examples. Polymerisation-types-addition and condensation with examples. Free radical mechanism of addition polymerization. Methods of polymerization – bulk, solution, suspension and emulsion. Thermoplastics and thermosetting plastics with examples, weight average and number average molecular weight. Glass transition temperature (T_g) – parameters affecting T_g and significance of T_g. Synthesis, properties and applications of PTFE, PMMA and PU

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

Adhesives– definitionsynthesis, properties and applications of epoxy resin.

Conducting polymers – definition and mechanism of conduction in polyacetylene.

9hrs

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., 33rd 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, Mc Graw Hill Publications.
7. Text book of Polymer science by F.W.Billmeyer, John, Wiley and Sons, 1994.
8. Environmental chemistry by Stanley E. Manahan, 7th edition, Lewis publishers, 2000.
9. Hand book of Nanotechnology, Bharath Bhushan, Spinger-Verlag Berlin Heidelberg New York.2004.

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Department : Chemistry

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Syllabus from the Academic year 2016-2017

Sub code: CHL 110/210

Credits: 1.5

Lab hours: 3 hrs

PART – A

1. Determination of total hardness of water by EDTA method .
2. Determination of total alkalinity of water sample and identification of the type and extent of alkalinity.
3. Determination of percentage of Copper in brass in the given sample of brass by iodometric method.
4. Determination of Iron in haematite solution using standard solution of potassium dichromate by external indicator method.
5. Determination of dissolved oxygen of the given water sample by Winkler's method
6. Determination of Chemical Oxygen Demand of an industrial effluent.

PART – B

1. Determination of p^{K_a} of weak acid using pH meter.
2. Estimation of iron in stainless steel/ FAS potentiometrically using standard solution of potassium dichromate.
3. Conductometric estimation of HCl and CH_3COOH present in a mixture using standard solution of sodium hydroxide.
4. Determination of copper colorimetrically using ammonia as the complexing agent.
5. Determination of iron (III) by colorimetric method using potassium thiocyanate as the complexing agent.
6. Determination of equivalent conductance of strong electrolyte at infinite dilution.
7. Flame photometric method of determining sodium in water sample.

Reference Books:

1. Vogel's text book of quantitative inorganic analysis, revised by J.Bassett, R.C.Denny, G.H.Jeffery, 4th Ed.
2. Applied chemistry theory and practice by O. P. Vermani and A. K. Narula, second edition.
3. Water and waste water analysis by American α -method (APHS).