Engineering Chemistry Theory (CH210)

2018-19

Course Objective

To impart the knowledge of applied aspects of chemistry and utilizing the same for the technological advancement in various discipline of engineering.

Course outcome

On successful completion of this course, the students will be able to

CO-1. Understand concepts of electrochemistry and applications of electrochemical concepts for surface modification techniques.

CO-2. Able to know the mechanism of corrosion and its control.

CO-3. Understand the importance of polymers as engineering materials and instrumental methods involved in chemical analysis.

CO-4. Know the importance of analysis of water and the technological applications of nanomaterials.

CO-5. To understand the fundamentals of chemical bonding, metallurgy and colloidal system.

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JSS Mahavidyapeetha
JSS Science and Technology University
Sri Jayachamarajendra College of Engineering, Mysore-570 006

Department: Chemistry **Subject: Engineering Chemistry Theory**

II semester B.E.
Syllabus for non circuit branches
Academic year 2018-2019

Sub code: CH210
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. Electrodes – Types-Reference electrodes – calomel electrode & Ag/AgCl electrode. Concentration cells – definition, construction and working. Ion selective electrode – glass electrtode, determination of pH using glass electrode.Numericals.

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 – brightners, 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- anodicand cathodic. Cathodic protection- sacrificial anode and impressed current techniques, Anodic protection.

8 hrs

UNIT – III

INSTRUMENTAL METHODS OF ANALYSIS

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

HIGH POLYMERS

Polymers – Introduction, Thermoplastics and thermosetting plastics with examples, weight average and number average molecular weight. Glass transition temperature (Tg) – parameters affecting Tg and significance of Tg. Synthesis, properties and applications of PTFE, PMMA and PU.
Adhesives– definition, synthesis, properties and applications of epoxy resin.
Conducting polymers – definition and mechanism of conduction in polyacetylene.

9 hrs

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 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

CHEMICAL BONDING AND THEORY OF IONIZATION

Ionisationenergy, electron affinity and periodicity. Conditions and energetics of formation of ionic and covalent bonds. Covalent bonds – polarity of covalent compounds and characteristics of covalent compounds. Difference between ionic and covalent compounds. Partial ionic characters of covalent bonds. Valence Bond approach, Sigma and Pi bonds. Geometry of molecules and hybridization. Metallic bonds.

METALLURGY

Principles of Metallurgy – Introduction, Characteristics of metals, Physical properties of metals, Sources of elements, occurrence of metals, slags and fluxes. Metals and metallic character, non-metals, metalloids. Classification of ores, Furnaces, Ore dressing.
Iron and steel- occurrence, impurities in ores and their effect, commercial forms of iron. Allotropic forms of iron. Properties of iron, effect of impurities on properties of cast iron.

COLLOIDAL STATE

Colloids – Introduction, Particle size, Classification of Colloids, Difference between colloidal solution, true solution and suspension. Preparation of colloids, Purification of colloidal soultions, Properties of colloids, stabilization of colloidal solutions, Interaction between hydrophobic and hydrophilic colloids, Brownian movement, Emulsions, Gels. Coagulation and Flocculation. Applications of colloids.

12 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., 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, 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, 7th edition, Lewis publishers, 2000.
9. Hand book of Nanotechnology, BharathBhushan, Spinger-Verlag Berlin Heidelberg New York.2004.

Engineering Chemistry Laboratory CH22L

Course objective

To impart practical knowledge in the field of chemical analysis with respect to conventional and instrumental methods of chemical analysis.

Course outcome

CO-1. Assessment of water quality parameter like hardness & alkalinity and judging the suitability of water for domestic and industrial applications.

CO-2. Analysing the importance of alloys and ores for engineering applications.

CO-3. Assessment of waste water quality parameters like BOD and COD in determining the extent of pollution.

CO-4. Applications of analytical techniques like potentiometry, pH metry and conductometry for accurate chemical analysis.

CO-5. Applications of analytical techniques like colorimetry for accurate chemical analysis.

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Department: Chemistry **Subject: Engineering Chemistry Laboratory**

II semester B.E.
Syllabus for non circuit branches
Academic year 2018-2019

Sub code: CH 22L
Credits: 1.5
Lab hours: 3hrs

PART – A

1. Determination of total hardness of water by Complexometric 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^{Ka} 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 colorimetricaly 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.

Reference Books:

1. Vogels text book of quantitative inorganic analysis, revised by J.Bassett, R.C.Denny, G.H.Jeffery,. 4^{th} 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).