

CHE124:ENGINEERING CHEMISTRY

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: understand the basic concepts and principles of chemical sciences in the field of engineering.

CO2 :: apply the knowledge of different methods for water analysis and purification.

CO3 :: employ the engineering applications of polymeric materials, lubricants, and nanomaterials.

CO4 :: discuss the electrochemical processes, fuel, batteries and corrosion control methods in daily life.

Unit I

Water and its Treatment : Types of hardness, Units of hardness of water, Determination of hardness by EDTA method, Alkalinity of water and its significance, Boiler feed water and its treatment, Softening methods and numerical problems based on these methods, Membrane based treatment processes, Water treatment by chlorination, Specifications for drinking water

Unit II

Polymers : Molecular shape and Crystallinity, Glass transition temperature (T_g), Basic factors affecting T_g (with examples, no details), structure, synthesis and applications of elastomers and common polymers, biodegradable polymers: classifications, uses and methods of degradation, conducting polymers: p-electron delocalization, doping mechanisms, and charge carriers (solitons, polarons, bipolarons), conductivity and transport in conducting polymers with applications in electronics, energy, and sensors,, lubricants: lubrication and its purpose, additives for lubricants, chemical and physical properties of lubricant, Basics of Polymer chemistry, Classification of polymers, Degree of polymerization, Structure-property relationship

Unit III

Nanomaterials : introduction to nanomaterials:, classification of nanomaterials based on dimensionality (0D, 1D, 2D, and 3D), carbon-based nanomaterials including fullerenes (buckyballs), carbon nanotubes, and graphene, electronic, optical, mechanical, and thermal properties of nanomaterials with size-dependent effects., methods of nanomaterial synthesis: top-down and bottom-up approaches,, applications of nanomaterials in catalysis, electronics and telecommunication, biomedical and pharmaceutical fields, and energy-related technologies such as batteries, supercapacitors, and solar cells

Composites : fundamental concepts of composite materials, role of matrix and reinforcement, composition, structure, and characteristic properties of composites, classification of composites based on reinforcement type, including particulate composites, fiber-reinforced composites, and structural composites, Engineering applications of composites

Unit IV

Electrochemistry : Cell constant determination, Specific and Molar conductance (numericals), Introduction to electrolytes, electrochemical cells and cell conductance, Electrolytic and galvanic cells, electrochemical series, cell emf measurement, Nernst equation and numerical problems, Thermodynamic overview of Electrochemical processes, Single electrode potentials (origin and HDL), Reversible and irreversible cells

Unit V

Corrosion : Definition and scope of corrosion, direct chemical corrosion, Electrochemical corrosion and different mechanisms, Types of electrochemical corrosion-Galvanic and concentration cells, Types of electrochemical corrosion-Differential aeration corrosion, Water-line corrosion and Pitting corrosion, Types of electrochemical corrosion-Intergranular and Soil corrosion and Factors affecting corrosion, Protection of corrosion, Protection of corrosion-Ceramic coating, Electroplating process

Unit VI

Energy sciences : determination of calorific value, analysis of coal, Ni-Cd, Ni-metal hydride battery, Li-ion battery, Lead storage battery, Li-air battery, Calorific value of fuels, Primary cells, Secondary batteries, Fuel cells- principles, applications, advantages/disadvantages, energy sciences: fuels and its types, hydrogen energy (production, storage, safety aspects) and significance as a clean and sustainable energy carrier, nuclear energy (principles of nuclear energy, sustainable energy production), spintronics and its engineering applications

Text Books:

1. ENGINEERING CHEMISTRY by PRASANTA RATH, Cengage India Private Limited

References:

1. ENGINEERING CHEMISTRY by DR. SUBA RAMESHM AND DR. S. VAIRAM, WILEY
2. ENGINEERING CHEMISTRY by PAYAL B. JOSHI, OXFORD UNIVERSITY PRESS