UNIT I

Chapter 1 : Water Technology and Green Chemistry 1-1 to 1-63

Impurities in water, hard water, hardness of water, its types, units of hardness and hardness calculation. Chemical analysis of water by determination of hardness by EDTA method. Alkalinity of water and its determination. Numericals on EDTA method and alkalinity. Disadvantages of hard water in boilers. Water softening techniques : Permutit and Ion exchange method. Water purification by reverse osmosis and electro-dialysis. Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).

Introduction of Green Chemistry : Definition, goals, principles and green synthesis of Polycarbonate.

UNIT II

a) Electrochemistry : Fundamentals of an electrochemical cell, EMF of cell, reference and indicator electrodes and Nernst Equation.

b) Basic principles, instrumentation and applications of :

i) Conductometry : Introduction, Kohlrausch's law, measurement of conductance and conductometric titrations of strong acid versus strong base, strong acid versus weak base and mixture of acids vs Strong base.

ii) pH metry : Theory of buffers and preparation, standardization of pH-meter, titration of weak acid versus strong base, simple and differential plots.

Battery technology : Introduction and types of batteries, construction, working and applications of Lithium ion battery, charging and discharging reactions at respective electrodes.

UNIT III

Chapter 3 : Spectroscopic Techniques 3-1 to 3-38

Spectroscopic techniques: Ultra Violet and IR spectroscopy

(a) UV Spectroscopy : Nature of electromagnetic radiation and its characteristics. Interaction of matter with UV radiations leading to different electronic transitions. Beer's & Lambert's law, their derivations and applications. Instrumentation of UV -Visible specrophotometer. Terms used in UV spectroscopy- chromophore, auxochrome, bathochromic shift (red shift), hypsochromic shift (blue shift), hyperchromic and hypochromic effect.

(b) IR spectroscopy : Principle, Condition for IR Spectroscopy, types of vibrations (stretching and bending), Different regions of IR spectrum such as fundamental group region, finger print region and aromatic region. Instrumentation of IR spectrophotometer with applications.

UNIT IV

Chapter 4 : Engineering Materials 4-1 to 4-45

Chemistry of Polymers and Novel Carbon Compounds

a) **Polymers : Definition, classification of polymers on the basis of thermal behavior, reaction mechanism of free radical and condensation polymerization with suitable examples. Advanced polymeric materials : Structure, properties and applications of liquid crystal polymer - Kevlar, conducting polymers - Polyacetylene, electroluminescent polymer - PPV, biodegradable polymers - PHBV, polymer composite - fibre reinforced polymer and recycling of polymers.**

b) **Nanomaterials : Definition, types of nanomaterials and properties of nanomaterials. Quantum dots, structure, synthesis, properties and applications of CNTs, Fullerenes and Graphene.**

UNIT V

Fuels : Definition, classification of fuels, calorific value and its units. Calorific value (CV), Gross Calorific Value (GCV), Net Calorific Value (NCV). Determination of calorific value - Bomb calorimeter, Boy's colorimeter and numericals.

i) **Solid fuels : Coal, classification of coal, proximate and ultimate analysis of coal, numericals based on analysis of coal.**

ii) **Liquid fuels : Origin of petroleum, composition of petroleum, refining of petroleum, Octane number of petrol and Cetane number of diesel. Synthesis reaction, properties, advantages and disadvantages of Power alcohol and Biodiesel.**

iii) **Gaseous fuels : Hydrogen gas as a future fuel, production by steam reforming of methane and coke, storage and transportation. H2- O2 fuel cell.**

iv) **Combustion : Chemical reactions, calculations on air requirement for combustion.**

UNIT VI

Chapter 6 : Corrosion Science 6-1 to 6-34

Corrosion : Introduction, types of corrosion, mechanism of atmospheric corrosion and wet corrosion. Electrochemical and galvanic series. Factors affecting corrosion : nature of metal and nature of environment.

Corrosion control : Methods of prevention of corrosion - cathodic and anodic protection, metallic coatings and its types - anodic and cathodic coatings. Method to apply metallic coatings - hot dipping, cladding, electroplating and cementation. Non-metallic coating - powder coating.

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