

Unit - I:

Molecular structure and Theories of Bonding: Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N₂, O₂ and F₂ molecules.

Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance.

Unit - II:

Water and its treatment: Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness. Numerical problems. Disadvantages of hard water.

Boiler troubles: Scales and sludges, Caustic embrittlement, boiler corrosion, softening of water by internal treatment of boiler feed water and ion exchange process. Desalination of water – Reverse osmosis. sewage water treatment. Potable water treatment-Potable water and its specifications. Disinfection of water by chlorination and ozonization.

Unit - III:

Electrochemistry, Batteries and Corrosion:

Electrochemistry: Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation , Electrochemical series and its applications. Batteries: Cell and battery – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery, advantages and applications of solid state battery.)

Fuel cells: Hydrogen-oxygen, solid polymerelectrolyte fuel cell. Bio chemical fuel cells- Advantages and Applications.

Corrosion and its control: Concept of corrosion. Types of corrosion.

Mechanism of chemical and electrochemical corrosion, Types of corrosion: (Galvanic, water-line and pitting corrosion and stress corrosion). Factors affecting rate of corrosion. Corrosion control methods- Principle of Cathodic protection – Sacrificial anode and impressed current cathodic methods.

Protective coatings: Metallic coatings –Hot dipping, metal cladding, cementation, electroplating of copper, electroless plating of Nickel. Paints.

Unit - IV:

Engineering materials:

Ceramics: Properties & types of ceramics. Engineering applications of ceramics

Polymers: Definition, classification, properties of polymers. Engineering applications of plastics (PVC, Teflon, Bakelite), fibres (Dacron, Nylon 6, FRP).

Conducting polymers- Mechanism of conduction, doping and applications of poly acetylene. Applications of bio degradable polymers.

Composites: Introduction- Constituents of composites – advantages, classification and applications of composites.

Lubricants: Definition, types, properties and mechanism of lubrication.

Unit - V:

Spectroscopic Techniques And Applications: Principles of spectroscopy, selection rules and applications of electronic spectroscopy. Vibrational and rotational spectroscopy. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift. Introduction to Magnetic resonance imaging