

Material Chemistry and Nanotechnology

UNIT 1: IONIC CONDUCTIVITY AND SOLID ELECTROLYTES :

Types of ionic crystals – alkali halides – silver chloride-alkali earth fluorides – simple stoichiometric oxides. Types of ionic conductors – halide ion conductors – oxide ion conductors – solid electrolytes – applications of solid electrolytes. Electrochemical cell – principles – batteries, sensors and fuel cells – crystal defects in solids – line and plane defects – point defects – Schottky and Frenkel defects. Electronic properties and band theory; metals, semiconductors – Inorganic solids – colour, magnetic and optical properties, luminescence (15h)

UNIT 2 : MAGNETIC MATERIALS

Introduction – types of magnetic materials – diamagnetism – paramagnetism, ferromagnetism. Ferrites : Preparation and their applications in microwave – floppy disk – magnetic bubble memory and applications. Insulating Materials: Classification on the basis of temperature – Polymer insulating materials and ceramic insulating materials. Ferroelectric materials: examples – applications of ferroelectrics. (15h)

UNIT 3 : MODERN ENGINEERING MATERIALS :

Metallic glasses – introduction – composition, properties and applications. Shape memory alloys: introduction – examples – application of SMA – advantages and disadvantages. Biomaterials : Introduction – metals and alloys in biomaterials – ceramic biomaterials, composite biomaterials-polymer biomaterials. (15h)

UNIT 4: NANOPHASE MATERIALS :

Introduction – techniques for synthesis of nanophase materials – sol-gel synthesis-electrodeposition – inert gas condensation-mechanical alloying – properties of nanophase materials – applications of nanophase materials, composite materials: Introduction – types. (15h)

UNIT 5: NANO TECHNOLOGY

Introduction – importance – various stages of nanotechnology – nanotube technology – nanoparticles – fullerenes-nanodendrimers – nanopore channels, fibres and scaffolds – CVD diamond technology – FCVA technology and its applications – nanoimaging techniques. (15h)

Books for Reference :

1. Anthony R. West, Solidstate chemistry and its applications, John Wiley & Sons(1989).
2. Raghavan V.R., Materials Science and Engineering, Prentice Hall (India) Ltd., (2001).
3. Kenneth J. Klabunde, Nanoscale materials in chemistry, A. John Wiley and Sons Inc. Publication.