

Material Science (Open Elective-B)

Mark-100

Unit-I

Mechanical, Thermal and electrical properties of materials, Mechanical properties: Tensile Strength, stress-strain behavior, Ductile and brittle material, Toughness, hardness, fatigue, creep and fracture.

Thermal properties: Thermal conductivity, thermoelectric effects, Electrical properties: electrical conductivity, energy band structure of conductors, semiconductors and insulators, type-I and Type-II superconductors and their application, dielectric, ferroelectric and piezoelectric materials and their application. (13)

Unit-II

Laser Physics:

Basic elements of a laser; Threshold condition; Four-level laser system, CW operation of laser; Critical pumping rate; Population inversion and photon number in the cavity around threshold; Output coupling of laser power. Optical resonators; Cavity modes; Mode selection; Pulsed operation of laser: Q-switching and Mode locking; Experimental technique of Q-switching and mode locking Different laser systems: Ruby, CO₂, Dye and Semiconductor diode laser;

Optical materials: optical properties-scattering, refraction, reflection, transmission and absorption, optical fibres-principle and application. (12)

Unit-III

Soft condensed matter:

Polymeric materials: Types of polymers, Mechanism of polymerization, Mechanical behaviour of polymers, Fracture in polymers, Rubber types and applications, Thermosetting and thermoplastics, Conducting polymers:

Composite Materials: Microcomposites & Macrocomposites, fibre reinforced composites, Continuous fibre composites, Short fibre composites, Polymer matrix composites, Metal-matrix composites:

Ceramic-matrix composites, Carbon-carbon Composites, Hybrid composites.

Ceramics: Types, structure, properties and application of ceramic materials

Other materials: Brief description of other materials such as Corrosion resistant materials, Nanophase materials, Shape memory alloy, SMART materials (15)