Chapter 1 : Wave Optics 1-1 to 1-31

Syllabus :

Interference : Interference, Phase difference & path difference between waves, Constructive & destructive interference, Geometrical path & optical path, Phase difference due to reflection at boundaries of optical interfaces, thin film, Interference due to thin film of uniform thickness, Conditions of maxima and minima, interference at wedge shaped film (without derivation), Antireflection coating as an application of interference.

Diffraction : Diffraction, Fraunhofer diffraction at a single slit (Derivation)-condition of maxima and minima, Resultant intensity distribution pattern, Diffraction grating (Qualitative), Introduction to X-Ray diffraction.

Chapter 2 : Semiconductor Physics 2-1 to 2-29

Syllabus : Limitations of classical free electron theory, Kronig -Penny model (qualitative), band theory of solids, direct & indirect energy band gap, electrical conductivity of conductors & semiconductors, Hall effect (with derivation), Fermi Dirac probability distribution function, Fermi energy, position of Fermi level in intrinsic semiconductors (with derivation) & In-extrinsic semiconductors, dependence of Fermi level on temperature & doping concentration, energy band diagram of P-N Junction diode, Solar cell I-V characteristics.

Chapter 3 : Laser and Fiber Optics 3-1 to 3-27

Syllabus :

Laser : Introduction, Interaction of light with matter- absorption, Spontaneous emission, Stimulated emission, Population inversion, Metastable state, Active system, Resonant cavity, Characteristics of laser, Semiconductor hetero-junction laser, Carbon dioxide laser, Applications of laser-industrial, Defense & medical; Introduction to holography

Fiber Optics : Propagation of light in optical fibers, Acceptance angle, Numerical aperture, Modes of propagation, Types of fibers- step index, graded index, single mode & multi-mode; Losses - attenuation, dispersion

Chapter 5 : Magnetism and Superconductivity 5-1 to 5-31

Syllabus :

Magnetism : Classification of magnetic materials, Temperature dependent magnetic transitions (Curie and Neel temperature), Magnetic hysteresis loop, Magneto-resistance, Giant Magneto-Resistance (GMR), Application of magnetic materials in magneto-optical recording, Magnetocaloric effect, Adiabatic demagnetization.

Superconductivity : Introduction, Critical temperature, Properties of superconductors-zero electrical resistance, Persistent current, Meissner effect, Critical magnetic field, Critical current, isotope effect, BCS theory, Type I and II superconductors, Low T_C and high T_C superconductors, Josephson effect, DC-SQUID-construction, working and applications, Applications - superconducting magnets, Maglev trains.

Chapter 6 : Introduction to Nanoscience 6-1 to 6-20

Syllabus : Introduction, Surface to volume ratio, Quantum confinement, Properties of nanomaterials- optical, electrical, mechanical, magnetic; Methods of preparation of nanomaterials- bottom-up and top-down approaches, Physical methods- high energy ball milling, Physical vapor deposition; Chemical methods-colloidal method, Chemical vapor deposition method (hybrid method); Applications aerogels- types, Properties and applications, Applications of nanomaterials in medical, Energy, Automobile, sensors, space, defense ; Introduction to quantum computing.

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