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.

1.1 Young's Double Slit Experiment 1-1

1.2 Concept of Waves and Huygens' Principle 1-2

1.2.1 Geometrical Path and Optical Path 1-3

1.2.2 Phase Difference and Path Difference 1-3

1.3 Interference 1-4

1.3.1 Conditions for Sustained Interference 1-5

1.4 Stokes Law 1-5

1.5 Interference in Thin Film 1-5

1.5.1 Interference due to Thin Film of Uniform Thickness [Reflected System] 1-5

1.5.2 Condition for Maxima and Minima in Reflected Light 1-7

1.6 Interference at Wedge Shaped Film : Non - uniform Thickness Film 1-7

1.7 Applications of Interference in the Field of Engineering 1-9

1.7.1 Nonreflecting or Antireflecting (AR) Coatings 1-9

1.8 Introduction to Diffraction 1-10

1.8.1 Types of Diffraction 1-11

1.8.2 Difference between Fresnel Diffraction and Fraunhofer Diffraction 1-13

1.9 Single Slit Diffraction 1-13

1.10 Plane Diffraction Grating 1-16

1.10.1 Diffraction due to the Grating (Qualitative) 1-17

1.11 Introduction to X-Ray Diffraction 1-19

1.12 Introduction to Polarisation 1-20

1.13 Production of Linearly Polarized Light 1-21

1.13.1 Law of Malus 1-21

1.13.2 Doubly Refracting Crystals 1-22

1.13.3 Geometry of Calcite Crystal 1-22

1.13.4 Double reflection (Birefringence) 1-23
1.13.5 Huygen's Theory of Double Refraction 1-24
1.14 Photoelasticity 1-24
1.15 Solved Numericals 1-25

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.

2.1 Lorentz-Drude Theory : Classical Free Electron Theory of Metals 2-2
2.1.1 Electrical Conductivity 2-2
2.1.2 Thermal Conductivity 2-3
2.1.3 Wiedemann-Franz Law 2-4
2.1.4 Success of Free Electron Theory 2-4
2.1.5 Limitations of Free Electron Theory 2-4
2.2 Kronig -Penny Model 2-5
2.2.1 Bloch Theorem 2-5
2.3 Formation of Energy Band in Solid 2-6
2.3.1 Classification of Solids on the Basis of Band Theory 2-7
2.4 Types of Semiconductors 2-8
2.5 Electrical Conductivity of Conductors 2-10
2.6 Conductivity in Semiconductor 2-11
2.6.1 Influence of External Factors on Conductivity (Temperature, Light, Impurity) 2-13
2.7 Hall Effect 2-13
2.8 Fermi Dirac Probability Distribution Function 2-15
2.9 Fermi Level 2-16
2.9.1 Position of Fermi Level in Intrinsic Semiconductors 2-16
2.9.2 Position of Fermi Level in Extrinsic Semiconductors 2-18
2.10 Energy Band Structure of p-n Junction Diode 2-19
2.11 Effect of Impurity Concentration on Fermi Level 2-21

2.12 Solar Cell 2-22

2.12.1 I-V Characteristics of Solar Cell 2-23

2.12.2 Factor to Improve Efficiency of Solar Cell 2-24

2.13 Solved Numericals 2-24

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

3.1 Interaction of Photons (Light) with Atoms (Lasing Action) 3-1

3.2 Population of Energy Levels and Thermal Equilibrium 3-4

3.3 Laser Characteristics 3-5

3.4 Laser Requirements/Components 3-6

3.4.1 Active Medium 3-7

3.4.2 Pumping Source 3-7

3.4.3 Optical Resonator 3-7

3.5 Energy Level Systems 3-8

3.5.1 Three Level Energy System 3-8

3.5.2 Four Level Energy System 3-8

3.6 Types of Lasers 3-9

3.6.1 Carbon Dioxide (CO_2) Laser 3-9

3.6.2 Semiconductor Laser 3-12

3.7 Applications of Lasers 3-15

3.7.1 Information Technology : Holography 3-15

3.7.2 Applications of Lasers in Medical 3-17

3.7.3 Applications in Defense 3-18

3.7.4 Industrial Applications 3-19

3.8 Introduction to Fiber Optics 3-19

3.8.1 Principle used in Fiber Optics Communication 3-20

3.9 Classification or Types of Fiber 3-21

3.9.1 Single Mode and Multimode Fibers 3-21

3.9.2 Classification of Optical Fiber based on Refractive Index 3-21

3.10 Acceptance Angle and Numerical Aperture 3-22

3.11 Generalized Fiber Optic Communication System 3-24

3.11.1 Advantages of Communication through Optical Fibers 3-25

3.12 Attenuation and Reasons for Attenuation 3-25

3.13 Solved Numerical 3-26

Chapter 4 : Quantum Mechanics 4-1 to 4-21

Syllabus : Limitations of classical physics, Need of quantum mechanics, Wave particle duality of radiation & matter, De-Broglie hypothesis, De-Broglie wavelength in terms of kinetic & potential energy, Concept of wave packet, Phase and group velocity, Properties of matter waves, Heisenberg's uncertainty principle, Wave function & probability interpretation, Well behaved wave function, Schrodinger's time independent wave equation, Applications of time independent wave equation to the problem of (i) Particle in rigid box, (ii) Particle in a non-rigid box(qualitative), Tunneling effect, examples of tunneling effect -alpha decay, Tunnel diode & Scanning Tunneling Microscope (STM)

4.1 Failure of Classical Mechanics and Need of Quantum Mechanics 4-1

4.2 Wave -Particle Duality 4-2

4.3 De-Broglie Hypothesis of Matter Waves 4-2

4.3.1 Statement 4-2

4.3.2 Wavelength of Matter Waves by Analogy with Radiation 4-3

4.3.3 Wavelength of Matter Waves in Terms of Energy E of the Particle 4-3

4.3.4 Wave Velocity of Matter Waves 4-4

4.3.5 Concept of a Wave Group or Wave Packet 4-4

4.3.6 Phase Velocity and Group Velocity 4-5

4.4 Properties of Matter Waves 4-5

4.5 Heisenberg's Uncertainty Principle 4-6

4.6 Wave Function · and Physical Significance of · 4-7

4.7 Schroedinger's Time Independent Wave Equation 4-7

4.8 A Particle in a Rigid Box (Infinite Potential Well) 4-9

4.9 A Particle in Nonrigid Box (Finite Potential Well) 4-12

4.10 Tunneling-Rectangular Potential Barrier 4-14

4.11 Examples of Tunneling 4-15

4.11.1 Alpha Decay 4-15

4.11.2 Tunnel Diode 4-16

4.11.3 Scanning Tunneling Microscope (STM) 4-18

4.12 Solved Numericals 4-19

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.

5.1 Classification of Magnetic Materials 5-1

5.2 Origin of Magnetization 5-2

5.2.1 Classification of Materials 5-3

5.3 Temperature Dependent Magnetic Transitions 5-3

5.4 Magnetic Hysteresis 5-4

5.5 Giant Magneto Resistance (GMR) 5-6

5.6 Application of Magnetic Materials in Magneto-optical Recording 5-8

5.7 Magneto-Caloric Effect 5-9

5.8 Production of Low Temperature by Adiabatic Demagnetization 5-11

5.9 Introduction to Superconductivity 5-11

5.10 Properties of Superconductors 5-12

5.10.1 Zero Resistance 5-12

5.10.2 Meissner - Ochsenfeld Effect 5-14

5.10.3 Isotope Effect 5-15

5.10.4 Critical Current (Ic) 5-16

5.11 BCS Theory of Superconductivity 5-16

5.12 Classification of Superconductors 5-18

5.12.1 Type I and II Superconductors 5-18

5.12.2 Low T_C and High T_C Superconductors 5-20

5.13 Josephson Junction and Josephson Effect 5-20

5.14 The Superconducting Quantum Interference Device (SQUID) 5-22

5.15 Applications of Superconductors 5-25

5.15.1 Superconducting Magnets 5-25

5.15.2 Maglev trains 5-26

5.16 Solved Numericals 5-26

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.

6.1 Origin of Nanoscience 6-1

6.1.1 Introduction : Nanotechnology and Nanoscience 6-1

6.1.2 History of Nanotechnology 6-1

6.2 Properties of Nanomaterials 6-2

6.2.1 Optical Properties 6-4

6.2.2 Electrical Properties 6-7

6.2.3 Mechanical Properties 6-8

6.2.4 Magnetic Properties 6-8

6.3 Methods of Preparation of Nanomaterials 6-9

6.3.1 High Energy Ball Milling 6-9

6.3.2 Physical Vapour Deposition Method 6-11

6.3.3 Chemical Vapour Deposition (CVD) 6-11

6.3.4 Chemical Method 6-13

6.3.4(A) Synthesis of Nanoparticles using Chemical Route 6-13

6.4 Aerogels 6-15

6.4.1 Introduction of Aerogels 6-15

6.4.2 Types of Aerogels 6-15

6.4.3 Properties of Aerogels 6-15

6.4.4 Applications of Aerogels 6-16

6.5 Applications of Nanomaterials 6-16

6.5.1 Medical 6-16

6.5.2 Energy 6-17

6.5.3 Automobile 6-17

6.6 Introduction to Quantum Computing 6-17

6.6.1 Potential Applications of Quantum Computing 6-18

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