

**Unit I****Chapter 1 : Interference 1-1 to 1-28**

Syllabus : Introduction to electromagnetic waves and electromagnetic spectrum, Interference in thin film of uniform thickness (with derivation), Interference in thin film wedge shape (qualitative) Applications of Interference : testing optical flatness, anti-reflection coating.

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| 1.6 | Necessity of the Extended Source | 1-6 |
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| 1.13.4 | Determination of Thickness of Very Thin Wire or Foil | 1-22 |
| 1.14 | Solved Problems | 1-22 |

Chapter 2 : Diffraction 2-1 to 2-26

Syllabus : Diffraction of light; Diffraction at a single slit, conditions for principal maxima and minima; diffraction pattern; diffraction grating; conditions for principal maxima and minima starting from resultant amplitude equation; Rayleigh's criterion for resolution; resolving power of telescope and grating.

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Chapter 3 : Polarization 3-1 to 3-9

Syllabus : Polarization of light, Malus' Law Double refraction, Huygens' theory of double refraction Application of Polarization : LCD

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Unit II

Chapter 4 : Laser 4-1 to 4-18

Syllabus : Basic of laser and its mechanism, characteristics of laser Semiconductor laser : Single Heterojunction laser Gas Laser : CO₂ Laser Applications of lasers : Holography, IT, Industrial, medical

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Chapter 5 : Optic Fibre 5-1 to 5-16

Syllabus : Introduction, parameters : Acceptance Angle, Acceptance Cone, Numerical Aperture Types of optical fibre- step index and graded index Attenuation and reasons for losses in optic fibres (qualitative) Communication system: basic building blocks Advantages of optical fibre communication over conventional methods.

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| 5.11 | Solved Problems..... | 5-11 |

Unit III

Chapter 6 : Quantum Mechanics 6-1 to 6-23

Syllabus : De-Broglie hypothesis Concept of phase velocity and group velocity (qualitative) Heisenberg Uncertainty Principle Wave-function and its physical significance Schrodinger's equations : time independent and time dependent Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in Rigid box) Particle in Finite potential well (Particle in Non Rigid box) (qualitative) Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode Introduction to quantum computing



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| 6.5.2 | Phase Velocity..... | 6-7 |
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| Unit IV |
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| Chapter 7 : Semiconductor Physics | 7-1 to 7-28 |
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Syllabus : Free electron theory (Qualitative) Opening of band gap due to internal electron diffraction due to lattice Band theory of solids Effective mass of electron Density of states - Fermi Dirac distribution function Conductivity of conductors and semiconductors Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration) Working of PN junction on the basis of band diagram Expression for barrier potential (derivation) Ideal diode equation Applications of PN junction diode : Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell Hall effect : Derivation for Hall voltage, Hall coefficient, applications of Hall effect

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| 7.2 | Band Theory of Solids | 7-1 |
| 7.3 | Classification of Solids | 7-3 |
| 7.4 | Free Electron Theory | 7-4 |
| 7.4.1 | Failures of Classical Free Electron Theory..... | 7-4 |
| 7.5 | Carrier Drift, Drift Velocity, Drift Current Mobility and Diffusion Current..... | 7-4 |
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| 7.6 | Fermi-Dirac Statistics..... | 7-6 |
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| 7.7.1 | Fermi Level in Conductor..... | 7-7 |
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| 7.9.2 | p-Type Semiconductors | 7-11 |
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| 7.9.4 | Effect of Temperature on p - type Material | 7-13 |
| 7.10 | Effect of Impurity Concentration on Fermi Level..... | 7-13 |
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| 7.11.2 | Calculation of Potential Barrier | 7-14 |



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| 7.12 | Biasing of P-N Junction | 7-15 | 8.4 | Introduction | 8-5 |
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| 7.13 | Hall Effect and its Applications | 7-17 | 8.6.2 | Isotope Effect..... | 8-8 |
| 7.13.1 | Experimental Determination of Mobility..... | 7-18 | 8.6.3 | Magnetic Field Effect (Critical field H_c)..... | 8-9 |
| 7.13.2 | Applications | 7-18 | 8.6.4 | Current Effect (Critical Current I_c and Critical Current Density J_c) | 8-10 |
| 7.14 | Applications of p-n Junction | 7-19 | 8.6.5 | Persistent Current..... | 8-11 |
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| 7.14.2 | Photovoltaic Cell..... | 7-19 | 8.7 | Types of Superconductors..... | 8-12 |
| 7.14.3 | Solar Cell..... | 7-19 | 8.7.1 | Comparison between Type I and Type II Superconductors..... | 8-13 |
| 7.15 | Solved Problems on Mobility, Conductivity and Resistivity..... | 7-21 | 8.8 | Low and High TC Superconductivity..... | 8-14 |
| 7.16 | Solved Problems on Fermi Level | 7-24 | 8.9 | Josephson Effect | 8-14 |
| 7.17 | Solved Problems on Hall Effect..... | 7-25 | 8.10 | Superconducting Quantum Interference Device (SQUID) | 8-16 |

Unit V

Chapter 8 : Magnetism and Superconductivity

8-1 to 8-20

Syllabus :

Magnetism : Origin of Magnetism, Classification of magnetism on the basis of permeability (qualitative) Applications of magnetic devices : Transformer cores, magnetic storage, magneto-optical recording.

Superconductivity : Introduction to superconductivity, Properties of superconductors, zero electrical resistance, critical magnetic field, persistent current, Meissner effect, Type I and Type II superconductors. Low and high temperature superconductors (introduction and qualitative), AC/DC Josephson effect, SQUID : Basis construction and principle of working, Applications of SQUID Applications of superconductors.

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| 8.1 | Origin of Magnetization using Atomic Theory :..... | 8-1 |
| 8.2 | Classification of Magnetic Materials : | 8-3 |
| 8.3 | Applications of magnetic devices | 8-4 |
| 8.3.1 | Transformer core..... | 8-4 |
| 8.3.2 | Magnetic Storage : | 8-4 |
| 8.3.3 | Magnet Optical Recordings | 8-5 |

Unit VI

Chapter 9 : Non Destructive Testing and

Nanotechnology

9-1 to 9-10

Syllabus :

Non Destructive Testing : Classification of Non-destructive testing methods Principles of physics in Non-destructive Testing Advantages of Non-destructive testing methods Acoustic Emission Testing Ultrasonic (thickness measurement, flaw detection) Radiography testing.

Nanotechnology : Introduction to nanotechnology Quantum confinement and surface to volume ratio Properties of nanoparticles: optical, electrical, mechanical Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile.



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| 9.1 | Introduction..... | 9-1 | 9.10.1 | Properties of Nano Particles | 9-9 |
| 9.2 | Classification of Non-Destructive testing methods..... | 9-1 | 9.10.2 | Applications in Mechanical Engineering | 9-9 |
| 9.3 | Understanding of Principles of Physics in NDT :..... | 9-2 | 9.10.3 | Applications in Electrical, Electronic and Communication Engineering..... | 9-9 |
| 9.4 | Objectives of Non-Destructive Testing : | 9-4 | 9.10.4 | Applications in Computer Science Engineering and IT | 9-9 |
| 9.5 | Acoustic Emission Testing | 9-4 | 9.10.5 | Applications in Bio - Medical and Chemical Energy | 9-9 |
| 9.6 | Ultrasonic Inspection Method | 9-4 | 9.11 | Risks of Nanotechnology | 9-9 |
| 9.7 | Radiography Testing | 9-6 | | ➤ Model Question Papers | M-1 to M-3 |
| 9.8 | Introduction to Nano-technology | 9-7 | | | |
| 9.9 | Quantum Confinement and Surface to Volume Ratio | 9-8 | | | |
| 9.10 | Properties and Applications of Nano Particles | 9-8 | | | |



Marking Scheme for University Theory Examination

| Unit No | Unit Name | In Semester Exam (30 Marks) Duration 1 Hr | End Semester Exam (70 Marks) Duration. 2 Hr. 30min. |
|---------|--|--|--|
| 1 | Wave Optics | 15 | - |
| 2 | Laser and Optic Fiber | 15 | - |
| 3 | Quantum Mechanics | - | 18 |
| 4 | Semiconductor Physics | - | 17 |
| 5 | Magnetism and Superconductivity | - | 18 |
| 6 | Non-Destructive Testing and Nanotechnology | - | 17 |
| | Total Marks | 30 | 70 |

