PH23207	PHYSICS FOR INFORMATION SCIENCE	3	0	0	3

(COMMON TO IT, IOT, AI&DS, AI&ML)

(For the candidates admitted during the Academic Year 2024-2025)

COURSE OBJECTIVES	

To enable the students to

1	gain knowledge about the conduction properties of metals.
2	correlate the different types of semiconducting materials.
3	gain knowledge about the types of laser and optical properties of materials.
4	introduce the different types of magnetic materials and its applications.
5	realize the dual nature of light and learn the basics of quantum computing.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

CONDUCTORS: Introduction to conducting materials-Merits and demerits of classical free electron theory; Quantum free electron theory - Fermi -Dirac distribution function - Effect of temperature on Fermi function; Density of energy states - Carrier concentration in metals.

SUPERCONDUCTORS: Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative); Type - I and Type II Superconductors - High temperature superconductors; Applications - Magnetic Levitation - SQUID.

UNIT II	SEMICONDUCTING MATERIALS	9

Types of Semiconductors - Elemental and Compound semiconductor; Intrinsic semiconductor: Expressions for density of electrons, holes and carrier concentration - Fermi level - Variation of Fermi level with temperature; Electrical conductivity - Band gap determination; Extrinsic semiconductors: n- type and p - type semiconductors (No derivation) - Hall effect - Determination of Hall coefficient –Basics of P-N Junction diode- Applications: LED - Solar cell.

UNIT III	LASER AND OPTICAL FIBER	9

Laser: Characteristics of laser - Stimulated absorption, spontaneous emission and stimulated emission - Population inversion; Pumping methods; Types of lasers - Nd-YAG, CO_2 and semiconductor (Homo) lasers - Applications: Laser Cutting - Welding - Bar code scanner.

Optical fiber: Principle, propagation of light through optical fiber - expressions for numerical aperture and acceptance angle; Types of optical fibers- Applications: Fiber optical communication system (block diagram).

UNIT IV	MAGNETIC MATERIALS	9

Introduction- Basic definitions-Classifications of dia, para, Ferro - Domain theory of ferromagnetism -Energies involved in the growth of magnetic domains- Hysteresis -Explanation of hysteresis curve based on domain theory- Soft and hard magnetic materials - Ferrites -Magneto resistance-Colossal Magneto Resistance- Giant magneto resistance- Applications - Spintronics and devices.

UNIT V	QUANTUM MECHANICS AND QUANTUM COMPUTING	9

Quantum mechanics : Wave particle duality- matter waves - de-Broglie wavelength; Wave function - Physical significance of the wave function- Einstein photoelectric effect - Schrodinger's time independent and time dependent equations - Applications: Particle in one dimensional box -degenerate and non-degenerate states.

Quantum Computing: Introduction to Quantum Computation -Quantum bits, Bloch sphere representation of a qubit, multiple qubits - Quantum Circuits: Single qubit gates -X Gate,Y Gate, Z Gate, Hadamarn gate, Multiple qubit gates-controlled NOT gate.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of the Course, the students will be able to		BT Mapped (Highest Level)
CO1	compute the properties of conducting and superconducting materials for suitable applications.	Apply (K3)
CO2	determine the carrier concentration and Hall co – efficient of semiconductor for optoelectronics applications.	Apply (K3)
CO3	classify the different types of laser and their uses in fiber optics	Apply (K3)
CO4	expose the knowledge of magnetic materials and their applications in data storage	Apply (K3)
CO5	examine the wave nature of particles and their uses in quantum computation.	Apply (K3)

TEXT BOOKS

1. A.Marikani, Material Science, PHI, New Delhi, 2017.
2. Md Nazoor Khan, S. Panigrahi, Principles of Engineering Physics 2, Cambridge University Press,2017.

REFERENCE BOOKS

1. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
2. P K Palanisamy, Material Science, SciTech Publications, 2015
3. Kasap, S.O. -Principles of Electronic Materials and Devices, McGraw - Hill Education, 2017.
4. Chuck Easton , Quantum computing Fundamentals Pearson Publishers, 2022.

CO PO MAPPING

Mapping of Course Outcomes with Programme Outcomes :
(1,2,3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	2	2	-	1	-	-
CO2	3	2	2	-	-	-	-	-	2	2	-	1	-	-
CO3	3	2	2	-	-	-	-	-	2	2	-	1	-	-
CO4	3	2	2	-	-	-	-	-	2	2	-	1	-	-
CO5	3	2	2	1	-	-	-	-	2	2	-	1	-	-

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PH23201 PHYSICS FOR INFORMATION SCIENCE 3 0 0 3

(COMMON TO IT, IOT,AI&DS, AI&ML)

(For the candidates admitted during the Academic Year 2023-2024)

COURSE OBJECTIVES

To enable the students to

- gain knowledge about the types of laser and optical properties of materials.
- Realize the dual nature of matter and applications of Schrodinger wave equation
- correlate the different types of semiconducting materials.
- introduce the different types of magnetic and superconducting materials and its applications.
- learn the basic knowledge of quantum bits

UNIT I LASER AND OPTICAL FIBER 9

Laser: Characteristics of laser - Stimulated absorption, spontaneous emission and stimulated emission - Population inversion; Pumping methods; Types of lasers - Nd-YAG, CO_2 and semiconductor (Homo) lasers - Applications: Optical data storage devices, CD - DVD - Blue-ray disc, Holographic data storage, laser cutting - Welding - Bar code scanner - laser printer.

Optical fiber: Principle, propagation of light through optical fiber - expressions for numerical aperture and acceptance angle; Types of optical fibers; Fiber optical communication system (block diagram) - Applications.

UNIT II ELEMENTARY QUANTUM PHYSICS 9

Black body radiation - Photons and light waves - Planck's theory (derivation); Compton effect (derivation) Electrons and matter waves - de-Broglie wavelength; Wave function - Physical significance of the wave function; Schrodinger's time independent and time dependent equations - Applications: Particle in one dimensional box - degenerate and non-degenerate states.

UNIT III SEMICONDUCTING MATERIALS 9

Types of Semiconductors - Elemental and Compound semiconductor; Intrinsic semiconductor: Expressions for density of electrons, holes and carrier concentration - Fermi level - Variation of Fermi level with temperature; Electrical conductivity - Band gap determination; Extrinsic semiconductors: n-type and p - type semiconductors (Qualitative); Hall effect - Determination of Hall coefficient – Applications: LED - Solar cell.

UNIT IV MAGNETIC MATERIALS AND SUPERCONDUCTORS 9

MAGNETIC MATERIALS: Domain theory of ferromagnetism - Hysteresis - Soft and hard magnetic materials - Ferrites - Applications

SUPERCONDUCTORS: Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative); Type - I and Type II Superconductors - High temperature superconductors; Applications - Magnetic Levitation - SQUID.

UNIT V QUANTUM COMPUTING 9

Introduction to Quantum Computation - Quantum bits, Bloch sphere representation of a qubit, multiple qubits - Quantum Circuits: Single qubit gates, Multiple qubit gates, design of quantum circuits.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- categorize the types of laser and fiber optics. predict the dual nature of matter, radiation and the application of the wave nature of particles.
- predict the dual nature of matter, radiation and the application of the wave nature of particles.
- discuss the basic idea of doping and determinations of Hall co - efficient.
- apply the knowledge of magnetic and superconducting properties of materials and its applications.
- interpret on the various terms related to quantum computing.

TEXT BOOKS

1. A.Marikani, Material Science, PHI, New Delhi, 2017.
2. Md Nazoor Khan, S. Panigrahi, Principles of Engineering Physics 2, Cambridge University Press,201

REFERENCE BOOKS

1. Umesh K Mishra & Jasprit Singh, Semiconductor Device Physics and Design, springer,2008.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
3. P K Palanisamy, Material Science, SciTech Publications, 2015
4. Kasap, S.O. -Principles of Electronic Materials and Devices, McGraw - Hill Education, 2017.
5. S.O. Pillai, Solid State Physics. New Academic Science, Publishers, 2018.

CO/PO Mapping

(3/2/1 indicates strength of correlation) 3 - Strong, 2 - Medium, 1 - Weak

COs		Programmes Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	2	-	-	-	-	2	3	-	-
CO2	3	3	3	2	-	2	3	-	-	-	3	2	-	-
CO3	3	2	3	-	2	-	-				3	2	-	-
CO4	3	3	3	2	2	-						3	-	-
CO5	2	2	2	-	-	2			-	-		2	-	-

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