SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

SCHOOL OF SCIENCE AND HUMANITIES

DEPARTMENT OF PHYSICS

SPHA1202	PHYSICS FOR INFORMATION SCIENCES	L	T	P	Credits	Total Marks
		3	0	0	3	100

(COMMEN TO B.E-COMPUTER SCIENCE, DATA STURUCTURE, ARTIFICIAL INTELLIGENCE, IoT, AND INFORMATION TECHNOLOGY)

Course Objective:

CO1: To learn about the wave Quantum mechanical concept to solve the equation of motion of systems.

CO2: To study the transport properties of solids via the band theory and employ to understand the applications of semiconductor.

CO3: Understanding the principle, different types and applications of LASER

CO4: To identify the magnetic materials for storage devices.

CO5: To understand the fundamental principles and working of sensors and display divices.

Unit I: Fundamentals of Quantum Physics behind computing 9 Hours

Introduction – electromagnetic waves - Photoelectric effect, Compton scattering, photons, wave - particle duality of radiation, de Broglie waves, wave-particle duality of matter. Physical interpretation of wave function - wave packets - Heisenberg uncertainty principle - Schrodinger time independent Equation - Eigen value, Eigen function. Physical applications of Schrödinger's equation to (i) square well potential in one dimension: transmission and reflection coefficient at a barrier – applications of Schrodinger equation in computational physics

Unit II: Physics of solids in computer components 9 Hours

Basics of solids - Origin of energy bands, band structure of conductors, semiconductors (n-type and p-type), insulators, half metals, semi metals. Metals - Free Electron Theory of metals, Fermi level, Fermi surface, density of states (Qualitative only). Wiede-mann Franz Law- Derivation. Semiconductors-Direct and indirect band gap, derivation of intrinsic carrier concentration in terms of energy band gap, experimental determination of energy band gap – applications of semiconductors in fabrication of basic components of modern computer

Unit III : Physics of laser behind photonic computing 9 Hours

Introduction, Lasers-Spontaneous and stimulated emission, condition for Laser action, Concept of stimulated and spontaneous emission, Population inversion, Fiber lasers; Semiconductor lasers: Laser materials, Laser structure, Frequency control of laser output- optical resonators (qualitative) Q factor-Injection Laser Diode (ILD), Quantum Cascade Laser, Comparison between ILD and QCL – applications of laser in optical/photonic computing-laser scanner-optical disc-Optical Tweezers

Unit IV: Materials behind storage applications 9 hours

Introduction- Magnetic materials and its types – Weiss/ Domain theory of Ferro magnetism – Magentic storage devices - Magnetic bubble formation theory and propagation – Types of storage devices- Floppy disk- Compact Disk - Hard drive-Magnetic drum-super disk-MRAM.

Introduction - superconducting materials – Properties – BCS theory – applications of superconducting materials – SQUID, MAGLEV, cryotron, quantum and supercomputers

Unit V: Modern Sensors and Advanced Display Devices 9 Hours

Introduction- Sensors, Types, mechanism, applications of each of pressure sensors – Bourdon tube-strain gauge, temperature sensors, vibration sensors, acoustic sensors, Photo Sensors - LDR and photo diode. Introduction to Display device, Photo Luminescence, LED (OLED, AMOLED), Liquid Crystal Displays, Quantum dot displays, seven/fourteen/sixteen segment displays.

References:

1. Griffiths, David J. Introduction to Quantum Mechanics. Pearson Prentice Hall,2004.
2. Shankar, Ramamurti**,** Principles of Quantum Mechanics. Plenum Press,1994.
3. Mahesh C Jain, Quantum Mechanics: A Textbook for Undergraduates,2017
4. Kittel, Charles. Introduction to Solid State Physics. John Wiley, 2004.
5. Ashcroft, Neil W., and N. David Mermin. Solid State Physics. New York, NY: Holt, Rinehart and Winston, 1976.
6. Materials Science & Engg. -An Int. William D. Callister& G.Rethwisch, 2013
7. R.Asokamani, Solid State Physics, second edition, Easwar press, 2015
8. R.K.Gaur&S.L.Gupta - Engineering Physics, DhanpatRai publication,2018
9. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India
10. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-HillInc G. Keiser, Optical Fiber Communications, McGraw-Hill Inc., 3rd Ed.(2000)

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 hrs**

Part A:10 questions of 2 marks each – No choice; 2 questions from each of the five units **20 marks**

Part B: 2 questions from each unit of internal choice; each carrying 16 marks **80 marks**