APPLIED PHYSICS - II

I B. Tech. - II Semester	L	T	P	C
Course Code: A3HS07	3	1	-	3

Prerequisites: Fundamentals in Physics and Mathematics.

COURSE OBJECTIVES:

1. Learn the behavior of matter waves and applications of Schrodinger wave equations and periodic potential Energy of electron.
2. Explain the classification of semiconductors and construction of LED, LCD & Solar cell
3. Discuss the different types of optical fibers how it is used for communication in optical fiber networks
4. Explain the engineering applications of ultrasonics and how super conductors are used in transmission lines
5. Describe the fundamentals in quantum computations and analyze how it can be used in Cryptography

COURSE OUTCOMES:

Upon successful completion of the course student will able to:

1. Conclude the dual nature of material particles and able to explain how moving particles are associated with its energies
2. Analyze how the Semiconductors are classified and their applications in various domains
3. Summarize the principles and fundamentals of optical fibers and their engineering applications
4. Explain the production of Ultrasonics and Analyze engineering applications of ultrasonics and Summerize Superconducting phenomenon
5. Originate the basic idea of quantum computing and explain the applications in secured quantum information

SYLLABUS

UNIT - I **(10 hours)**

Quantum Mechanics: Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's Experiment, Heisenberg's Uncertainty Principle, Schrodinger's Time Independent Wave Equation-Physical Significance of the wave Function, Particle in One Dimensional Potential Box.

Band Theory of Solids: Fermi-Dirac Statistics (Qualitative treatment), Electron in a periodic potential-Bloch theorem, Kronig –Penny Model (Qualitative treatment), Origin of Energy Band formation in Solids, Classification of Materials into Conductors, Semiconductors & Insulators, Effective mass of an Electron.

UNIT - II **(10 hours)**

Semiconductor Physics: Intrinsic and Extrinsic Semiconductors, Fermi Level, Fermi level in Intrinsic and Extrinsic Semiconductors, Direct and Indirect Band gap semiconductors, Hall Effect and Applications.

Physics of Semiconductor Devices: LED materials- Construction and Working of LED, Advantages and Disadvantages. LCD-Characteristics of LCD, Action of LCD display device. Solar Cells-Photovoltaic effect, Efficiency Issues, Solar materials, Advantages of Solar Cells.

UNIT – III **(08 hours)**

Fundamentals of Fiber Optics: Structure and Principle of Optical Fiber, Acceptance Angle, Numerical Aperture. Types of Optical Fibers-Step Index and Graded Index fibers; Modes of fibers-SMSI, MMSI, MMGI, Attenuation and dispersion in Optical Fibers, Optical fiber Communication System with block diagram.

Fiber Optics sensors: Basic principle of Sensors, Classification of Optical sensors - Active, Passive, Intrinsic and Extrinsic sensors, Construction and working of Pressure, Temperature, Displacement and Liquid level Sensors.

UNIT – IV **(10 hours)**

Ultrasonics: Introduction – Types of ultrasonics: Longitudinal, transverse, Surface and Lamb waves. Properties of ultrasonics, Production of Ultrasonic waves - Magnetostriction and Piezoelectric methods, Detection of Ultrasonic waves- Acoustic grating,Kundt's method, Sensitive flame, Thermal detection and piezoelectric detection. Cavitation effect-uses. Engineering applications of Ultrasonics: NDT Testing.

Superconductivity: Zero resistance, Critical temperature Tc, Critical field Hc. Perfect diamagnetism,-Meissner effect. Type I and Type II superconductors. Formation of Cooper pairs, Electron-Phonon interaction and BCS theory. Applications of Superconductors.

UNIT – V **(10 hours)**

Quantum computation and cryptography: Introduction to cryptography, Classical and Public key cryptosystems, Vernam cipher, The RSA protocol;

Idea of classical bits and qubits, Bloch vector representation of state of qubit. Single qubit logic gates-pauli X, Y, Z and Hadmard gate in matrix form. Two level gates: CNOT and SWAP gate. Comments on No cloning theorem; Quantum Key distribution protocol -BB84 protocol; Quantum Teleportation – Basic Idea;

TEACHING METHODOLOGIES:

1. Animation videos
2. Assignments uploaded in website.
3. Tutorial questions uploaded in website.
4. Handbook uploaded in website.

PRESCRIBED BOOKS:

1. Modern Engineering physics-I & II : S. Chandralingam, K. Vijayakumar, S Chand Co.
2. Engineering Physics: P.K.Palanisamy, Scitech Publishers.
3. Engineering Physics: S.O.Pillai, New age International.
4. Nielsen M. A., I. L Chung, Quantum Computation & Quantum Information, Cambridge Univ. Press

REFERENCE BOOKS:

1. Solid State Physics: Charles Kittel, Wiley & Sons (Asia) Pvt. Ltd.
2. Fundamentals of physics:Halliday,Resnick,Walker.
3. Engineering Physics – By V Rajendran, Mc Graw Hill Edn.
4. Solar Photovoltaics – Fundamentals, Technologies and Applications 3rd Edition, PHI
5. Principles of Quantum computation and Information – By G. Benenti, G. Casati, G. Strini, World scientific.