SUBJECT CODE: UPH122C/UPH222C	ENGINEERING PHYSICS	CREDITS: 4
L:T:P - 4 : 0: 0		CIE Marks: 50
Total Hours/Week: 52		SEE Marks: 50

UNIT-I	13 Hrs.

Modern Physics and Quantum Mechanics:

Introduction. Quantization of energy levels, Frank-Hertz experiment. Wave particle dualism, de-Broglie hypothesis, de-Broglie wavelength, de-Broglie wavelength associated with electrons. Davisson and Germer experiment. Matter waves and their characteristic properties. Phase velocity, group velocity, expression for group velocity (superposition of two waves). Relationbetween phase velocity and group velocity in dispersive medium, relation between group velocity and particle velocity. Relation between phase velocity,group velocity and velocity of light. Expression for de- Broglie wavelength using the concept of group velocity. Application of de-Broglie hypothesis.Heisenberg's uncertainty principle and its physical significance (no derivation). Application of uncertainty principle (non-existence of electron inthe nucleus). Wave function, Properties and physical significance of a wave function. Probability density and normalization of a wave function. Setting upof a one dimensional time independent Schrodinger wave equation. Eigenfunctions and eigen values. Applications of Schrodinger wave equation- eigenfunction and energy eigen values of a particle in a potential well of infinite height and for a free particle. Finite potential well (qualitative) and tunnel effect (qualitative) and its applications.

UNIT–II	13 Hrs.

Electrical Properties of Metals and Semiconductors:

Free electron concept (Drude-Lorentz Theory). Classical free electron theory- assumptions. Mean collision time, mean free path, relaxation time and drift velocity. Expression for drift velocity. Expression for electrical conductivity inmetals. Effect of impurity and temperature on electrical resistivity of metals (Matthiessen's rule). Failures of classical free electron theory. Quantum free electron theory-assumptions. Fermi-Diarc statistics. Density of states and its derivation (3 dimension). Fermi energy, Fermi factor and variation of Fermi factor with energy for different temperatures. Derivation of Fermi energy for0K. Merits of quantum free electron theory.

Semiconductors, concentration of electrons and holes in intrinsic and extrinsic semiconductors (qualitative). Fermi level in intrinsic and extrinsic semiconductors (qualitative). Direct and indirect band gap semiconductors. Derivation of electrical conductivity for semiconductors. Hall effect, derivation of Hall voltage and Hall coefficient, experimental measurement ofHall voltage and Hall coefficient. Applications of Hall effect.

Superconductivity:

Temperature dependence of resistance in conductors and superconductors. Meissner effect, critical magnetic field, Type I and Type II superconductors. BCS theory (qualitative). Applications of superconductors

UNIT–III	13 Hrs.

Crystal Structure:

Space lattice, unit cell, primitive cell, lattice parameters, crystal systems, Bravais lattices. Directions and planes in a crystal. Miller indices. Expression for inter-planar spacing in terms of Miller indices. Co-ordination number, atomic packing factor for SC, BCC, FCC. Relation between lattice constant and density of material. Crystal structures of CsCl, NaCl, ZnS and Diamond.Bragg's Law and Bragg's X - ray spectrometer - determination of wavelength.Determination of cubic crystal structures using diffractrograms.

Dielectric materials:

Polar and non-polar dielectrics. Dielectric polarization, polarization process inpolar and non-polar dielectrics, polarization mechanisms. Dielectric constant,relation between polarization and dielectric constant. Internal field and derivation of internal field in solids and liquids (one dimensional). Clausius - Mossotti relation. Frequency dependence of polarization. Dielectric loss andits derivation. Ferroelectrics and piezoelectrics. Applications of dielectric materials.

UNIT–IV	13 Hrs.

Lasers:

Introduction, absorption, spontaneous emission and stimulated emission,Einstein's coefficients (expression fo density). Conditions for laser action, requisites of a laser system, working mechanism. Characteristics of Classification of lasers. Construction and working of Nd:YAG, carbon dioxide and semiconductor diod Applications of lasers- industry, defense, medical and environmental. Holography-construction and reconstru hologram. Applications of holography. Laser Safety.

Optical fibers:

Introduction, propagation mechanism in optical fibers, angle of acceptance, numerical aperture and its de Modes of propagation (qualitative), types of optical fibers and attenuation. Applications-optical fiber commu system, optical fiber as a sensor and fiber laser.

Ultrasonic and Shock Waves:

Ultrasonic Waves: Introduction, generation of ultrasonic waves (magnetostriction and piezoelectric meth properties. Measurement of velocity of ultrasonic waves in solids and liquids. Applications of ultrasonic wa destructive testing of materials, Medical and elastic constants of solids and liquids.

Shock Waves: Mach number, distinctions between- acoustic, ultrasonic, subsonic and supersonic waves. Shoc – characteristics. Method of producing shock waves –Reddy shock tube. Applications of shock waves.

Reference Books *

1. Author/s last Name, initial (Year), Book Title (edition), Publisher

1. Wiley precise text book series, (2014)"Engineering physics", Wiley India Pvt.Ltd.,
2. Chintoo S. Kumar, K. Takayana and K. P. J. Reddy,(2014) "Shock waves madesimple",Wiley India Pvt. Ltd.
3. R.K.Puri and V.K.Babbar, "Solid state physics"(2010), S.Chand & Company.
4. K.Rajagopal,(2009) "Engineering physics", PHI.
5. V.Rajendran, (2009)"Engineering physics", Tata McGraw Hill,.
6. Kenneth Krane ,"(2006) Modern physics",(second edition), Wiley India Pvt. Ltd.
7. Arthur Beiser, "2002Modern physics",(sixth edition), T.M.H,
8. B. B. Laud, "(1991)Lasers and non linear optics", (second edition), New AgeInternational.

Course Outcomes**

After completion of the course student will be able to

1. An ability to apply basic concepts and principles of physics toidentify, formulate and solve engineering problems.
2. An ability to use basics of modern physics and quantum mechanicsfor modern developments in engineering applications.
3. Gain the knowledge of basics, properties and applications ofmaterials.
4. An ability to identify a new material and its crystal structure.
5. Concepts of laser and optical fiber help in design and development ofnew devices for engineering applications.
6. Gain the knowledge of properties and engineering applications ofultrasonic waves and shock waves.

SUBJECT CODE:UPH127L/227L	**Engineering Physics Laboratory**	Credit -1.5
Hrs/Week : 03		CIE Marks : 50
Total Hours: 30		SEE Marks : 50

LIST OF EXPERIMENTS

Sl No	Title of the Experiment
1	The study of frequency response in series and parallel LCR circuits.
2	Black box experiment to identify passive components and estimate their values
3	Verification of Stefan's law.
4	Determination of Fermi energy for a conductor.
5	Photo diode characteristics.
6	Determination of Planck's constant using LEDs
7	Measurement of wavelength of a laser using diffraction grating.
8	Determination of dielectric constant of a material in a capacitor by RC charging and discharging method
9	Measurement of velocity of ultrasonic waves in a liquid using ultrasonic interferometer.
10	Determination of cubic crystal structures using diffractograms
11	Determination of Young's modulus of a metal strip by single cantilever method.
12	Determination of Rigidity modulus of a wire by torsional pendulum method.

Note:

1. Minimum eight experiments are to be conducted in a semester
2. The student has to perform one experiment during Lab CIE Test
3. The student has to perform one experiment during the SEE practical examination

Course outcomes:

1. Apply experimental skills for solving engineering problems
2. Use measuring tools for precision measurements
3. Measure properties of different materials
4. Exhibit documentation skill in the form of experimental write-up