ENGINEERING PHYSICS

SYLLABUS from the year 2011-2013

Course Code: 11PY1ICPHY/ 11PY2ICPHY L-T-P: 4-0-1

Credits: 05 Hours/Week: 06

UNIT – 1: Quantum Mechanics

Limitations of classical mechanics (Review), Wave particle dualism, de-Broglie hypothesis, Davisson and Germer experiment. Definition and expression of phase velocity and group velocity. Relation between group velocity - phase velocity, group velocity – particle velocity and group velocity – phase velocity and velocity of light. Derivation of de-Broglie wavelength using group velocity. Matter waves – characteristic properties.

Heisenberg's uncertainty principle – statement and physical significance. Application of uncertainty principle (Non-existence of electron in the nucleus). Wave function. Properties and physical significance of a wave function. Probability density and normalization of wave function. Setting up of a one-dimensional time independent Schrödinger wave equation. Eigen functions and eigen values. One dimensional time independent Schrödinger wave equation for a particle in a box/well - eigen functions, eigen values and probability. Finite potential wells and tunneling – example of α - decay. Problems.

11 Hours

UNIT – 2: Crystal Structure and X-ray Diffraction

Space lattice, Bravais lattice, unit cell, primitive cell, lattice parameters, crystal systems, planes in a crystal. Miller indices – Expression for interplanar spacing in terms of Miller indices. Relation between lattice constant and bulk density. Co-ordination number. Relation between atomic radius and lattice constant. Atomic packing factor. Problems.

Bragg's law, Bragg's diffractometer, Laue and powder diffraction methods of structure determination. Neutron and electron diffraction (qualitative). Problems.

10 Hours

UNIT – 3: Properties of Solids.

Electric Properties: Quantum free electron theory, Fermi velocity, Fermi temperature, Fermi energy, and Fermi factor. Dependence on temperature of f(E). Concept of effective mass, electrical conductivity (qualitative expression using Fermi velocity). Merits of quantum free electron theory. Density of states-expression. Problems.

Thermal Properties: Thermal conductivity, expression for thermal conductivity, Wiedemann – Franz law.

Magnetic Properties: Brief review – Classification – Ferromagnetic materials – Weiss's domain theory. B-H graph in ferromagnetic materials using the concept of domains. Soft and hard magnetic materials – characteristic features and applications. Ferrites – Features and applications.

10 Hours

UNIT – 4: Lasers and Optical Fibers

Characteristic features of lasers. Interaction of radiation with matter – Einstein's coefficients. Laser action – condition for laser action – basic requisites of a laser system. Construction and working of He-Ne laser and Semiconductor laser. Applications: Measurement of atmospheric pollutants. Holography – recording of hologram and reconstruction of image. Application of holography: Interferometry and holographic memories. Problems.

Principle and propagation mechanism in optical fibers. Angle of acceptance. Numerical aperture. Types of optical fibers and modes of propagation. Attenuation. Applications – optical communication: Block diagram and discussion of point to point communication. Advantages. Problems.

10 Hours

UNIT – 5: Theory of Vibrations

Theory of free vibrations: Periodic motion, simple harmonic motion, equation of a simple harmonic oscillator, expressions for period and frequency, energy considerations-total energy, conversion of energy from kinetic to potential, electric to magnetic, problems.

Theory of damped vibrations: Resistive forces, equation of motion-expression for decaying amplitude, two cases of damping (effect of damping on frequency and large damping force), problems.

Theory of forced vibrations and resonance: Equation of motion-expression for amplitude, mechanical impedance, expression for maximum amplitude, examples of resonance, problems.

Theory of coupled oscillation (qualitative description). Examples of electrical and mechanical coupling.

Resonant cavities: Acoustic and optical (laser) resonant cavities.

Resonant energy transfer: Introduction, brief description of NMR and ESR. Problems.

11 Hours

Text Books

1. Solid State Physics – Fifth edition – S O Pillai – New Age International.
2. Concepts of Modern Physics – Fifth edition- Arthur Beiser – Tata Mcgraw-Hill.
3. Acoustics, Waves and Oscillations – S N Sen, New Age International.
4. Textbook of Engineering Physics – M N Avadhanulu and Kshirsagar P G – S Chand
5. Engineering Physics – V Rajendran - Tata Mcgraw-Hill.
6. Textbook of Engineering Physics –S P Basavaraju – Subhash Stores

Reference Books:

1. Engineering Physics – R K Gour and S L Gupta – Dhanpat Rai Publication.
2. Elementary Solid State Physics – M Ali Omar Addison Wesley.
3. Solid State Physics – A J Dekker – MacMillan

LIST OF EXPERIMENTS

(Ten to be performed)

1. Measurement of wavelengths of various lines in the spectrum of mercury source using diffraction grating.
2. Measurement of radius of curvature of a plano convex lens by Newton's rings.
3. Measurement of Fermi energy of copper/aluminium using Calender and Griffith's bridge.
4. Determination of inductance of the coil using LCR series and parallel resonance.
5. Measurement of wavelength of laser source using diffraction grating.
6. Determination of moment of inertia of irregular body/rigidity modulus of the material using torsion pendulum.
7. Determination of dielectric constant of the material by charging and discharging of the capacitor.
8. I – V characteristics of a Zener diode.
9. B-H Curve.
10. Determination of band gap of a semiconductor.
11. Determination of frequency of AC mains using sonometer.
12. Determination of Young's modulus of a material by single cantilever.
13. Coupled pendulum.
14. Electrical/thermal conductivity of a given material.