ENGINEERING PHYSICS

SYLLABUS for the year 2013-2014

Course Code: 13PY1ICPHY/ 13PY2ICPHY 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 and phase velocity in dispersive medium, relation between group velocity and particle velocity, relation between group velocity, phase velocity and velocity of light. Derivation of de-Broglie wavelength using group velocity. Matter waves – characteristic properties. Problems.

Heisenberg's uncertainty principle – statement, proof and physical significance. Applications 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 one-dimensional time independent Schrödinger wave equation. Eigen functions and eigen values. Applications of Schrodinger's wave equation: 1. Free particle, 2. Particle in a one dimensional potential well of infinite height. (Eigen functions, eigen values, normalization and probability density need to discussed). Quantum confinement. Problems.

11 Hours

UNIT – 2: Crystal Structure, Electrical and Thermal Properties of Solids

Crystal Structure: Introduction to crystallography, directions and planes in a crystal. Miller indices, expression for interplanar spacing in terms of Miller indices. Bragg's law. Laue and powder diffraction methods of finding lattice parameters.

Electric Properties: Mention of classical free electron theory with limitations. Quantum free electron theory, Fermi energy, Fermi factor, dependence of f(E) on temperature, Fermi velocity, Fermi temperature. Electrical conductivity (qualitative expression using Fermi velocity). Merits of quantum free electron theory.

Thermal Properties: Thermal conductivity, expression for thermal conductivity of a conductor using classical free electron theory, derivation of classical Wiedemann – Franz law. Problems.

11 Hours

UNIT – 3: Magnetic and Dielectric Materials

Magnetic Materials: Classification of magnetic materials (Review), ferromagnetic materials – characteristic features, Weiss's domain theory. B-H graph in ferromagnetic materials using the concept of domains. Soft and hard magnetic materials – characteristic features, explanation using domain theory and applications. Ferrites – features and applications.

Dielectric Materials: Introduction, polarization – types of polarization. Frequency dependence of polarizability. Expression for dielectric constant and dielectric loss. Expression for internal fields in liquids and solids (one dimensional). Clausius – Mossotti relation. Problems.

10 Hours

UNIT – 4: Lasers and Optical Fibers

Introduction. 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. Characteristics of lasers. Applications of lasers: 1. Measurement of atmospheric pollutants. 2. Holography – recording of hologram and reconstruction of image. Application of holography. Problems.

Introduction. Principle and propagation mechanism in optical fibers. Angle of acceptance. Expression for numerical aperture. Types of optical fibers and modes of propagation. Coefficient of attenuation, causes of attenuation. Applications – optical communication: Block diagram and discussion of point to point communication. Advantages of optical communication system over conventional communication system. 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 in SHM, electric to magnetic in an LC circuit. Problems.

Theory of damped vibrations: Resistive forces, equation of motion-expression for decaying amplitude, cases of damping. Logarithmic decrement, relaxation time and quality factor. Problems.

Theory of forced vibrations and resonance: Equation of motion-expression for amplitude, mechanical impedance, expression for maximum amplitude. Problems. Examples of resonance-ESR and NMR.

10 Hours

Text Books

1. Engineering Physics – R K Gour and S L Gupta – Dhanpat Rai Publication.
2. Textbook of Engineering Physics – M N Avadhanulu and Kshirsagar P G – S Chand
3. Engineering Physics – V Rajendran - Tata Mcgraw-Hill.
4. Textbook of Engineering Physics –S P Basavaraju – Subhash Stores

Reference Books

1. Solid State Physics – A J Dekker – MacMillan
2. Solid State Physics – Fifth edition – S O Pillai – New Age International.
3. Concepts of Modern Physics – Fifth edition- Arthur Beiser – Tata Mcgraw-Hill.
4. Acoustics, Waves and Oscillations – S N Sen, New Age International.

LIST OF EXPERIMENTS

(Ten to be performed)

1. Measurement of Fermi energy of copper/aluminium using Calender and Griffith's bridge.
2. Frequency response of an LCR circuit.
3. Measurement of wavelength of laser source using diffraction grating.
4. Determination of moment of inertia of irregular body/rigidity modulus of the material using torsion pendulum.
5. Determination of dielectric constant of the material by charging and discharging of the capacitor.
6. I – V characteristics of a Zener diode.
7. B-H Curve.
8. Determination of band gap of a semiconductor.
9. Determination of frequency of AC mains using sonometer.
10. Determination of Young's modulus of a material by single cantilever.
11. Planck's constant or determination of wavelength of different LED's.
12. To study the divergence of laser beam.

Reference Books

1. Practical Physics - Harnam Singh and Dr. P. S. Hemne - S Chand and Co Ltd.
2. Practical Physics - R. K. Shukla and A. Srivastava - New Age International Pvt. Ltd.