**COURSE CODE : PH1C03**

**COURSE TITLE** : **APPLIED PHYSICS II**

**UNIVERSITY : DIBRUGARH UNIVERSITY**

**SEMESTER : SECOND SEMESTER**

**L:T:P : 3:1:0**

**CREDIT : 04**

**End sem. Examination for this course will carry 100 marks**

|  |  |  |
| --- | --- | --- |
| Module | Details of module | No. of Lectures |
| 1 | ***Solid State Physics*** covering Free electron theory (qualitative), Fermi energy, Fermi- Dirac distribution function(with derivation), Kronig-Penny model(qualitative)–formation of allowed and forbidden energy bands, Concept of effective mass–electrons and holes, Density of states (qualitative), Electron scattering and resistance, magneto-resistance, Hall effect (with derivation);Semiconductors and insulators–direct & indirect band gaps, Fermi level for intrinsic (derivation) and extrinsic semiconductors(dependence on temperature and doping concentration). Diffusion and drift current (qualitative), Conductivity and photoconductivity, Optical response; Classification of different types of diode on the basis of doping concentration (rectifier diode, Zener diode, tunnel diode); Concept of optoelectronics, Light Emitting Diode (as direct band gap material), solar cell, avalanche and photodiode; | 12 |
| 2 | ***Laser*** covering Fundamentals of LASER-Energy levels in atoms, radiation-matter interaction, absorption of light, spontaneous emission of light, Stimulated emission of light– population of energy levels, Einstein A and B coefficients, Metastable state, population inversion, resonant cavity, excitation mechanisms, Lasing action; Properties of laser, characteristics of different types of laser; Types of laser-Solid State Laser: Nd–YAG, Gas Laser – He-Ne, Semiconductor Laser; Applications of Laser in Engineering – drilling, welding, micro machining, measurement of long distances, in CD write devices & printers, in Medicine as a surgical tool, in Nuclear fusion, Holography, Optical signal processing and Remote sensing of the atmosphere; Laser safety | 12 |
| 3 | ***Introductory Quantum Mechanics***covering Concept of de Broglie’s Matter waves, derivation of wavelength of matter waves in different forms, Heisenberg’s Uncertainty principle, illustration-why an electron cannot exist in the nucleus; Concept of Phase velocity and Group velocity(qualitative);Concept of wave function Ψ and interpretation of |Ψ|2; Schrödinger’s Time independent equation, Applications of Schrödinger’s equation (qualitative treatment)–a)Particle in one dimensional rigid box, b) Potential Barrier (emphasis on tunneling effect) tunnel diode, scanning-tunneling microscope c)Hydrogen atom model(qualitative); Selection rules Elements of linear vector spaces-The idea of *n*–dimensional vector space, use of ‘bra-ket’ notation, linear independence, basis, inner product, norm of a vector; Hilbert space, Ortho normality; Matrix representation of kets and linear operators; Pauli matrices; Definitions of Hermitian, Inverse and Unitary operators; Commutators; Tensor products. | 12 |
| 4 | ***Thermal Physics*** covering Concept of Heat: Lattice vibrations–Einstein(individual) and Debye (collective), Boltzmann’s distribution; Definition of temperature in terms of Boltzmann’s distribution; Concept of entropy, specific heat; Attaining low temperature by variation of parameter X (like pressure, magnetic field etc.) in two steps-isothermal increase of X followed by adiabatic decrease of X. Example: a) Liquefaction of gas with X= Pressure; b) Adiabatic demagnetization; Transfer of heat by conduction, convection and radiation-Conduction in a) solids b) liquids c)gases; Convection- heat and mass transfer; Radiation- Stefan’s law (statement and equation); Thermal diffusivity; Applications like, Insulation-Glass Dewar/Thermos flask ,Super insulation Dewar, High temperature furnaces; Heat pipes; Heat sinks and Forced cooling/Radiators; Heat exchangers; Solar water heater. | 12 |

## Text/Reference Books:

1. Kittel C.,Introductionto SolidStatePhysics*,*WileyEastern
2. Solid State Physics by AJ Dekker
3. Elementary Solid State Physics by Omar, Pearson Publication
4. LaudB.B.,LasersandNon-LinearOptics,NewAgePublications
5. Essentials of Laser Physics by GD Baruah, Pragati Prakashan
6. Quantum Mechanics by Leonard I Schiff
7. Quantum Mechanics by G Aruldhas
8. A treatise on Heat by Saha & Srivastava
9. GuyK.White,ExperimentalTechniquesinLowTemperaturePhysics,OxfordSciencePublications
10. Books with titles-Engineering Physics