Physics -2
PH301
Contacts - 4L
Credits - 3 +1

Module 1
Vector Calculus
1.1 Physical significances of grad, div, curl. Line integral, Surface integral, volume integral - physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cy;indrical co-ordinates. [2L]

Module 2
Electricity
2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form, Electrostatic potential and field, Poisson's Equ (Application to Cartesian, Spherically and Cylindrically symmetric systems - effective 1D problem) Electric current, drift current, drift velocity, current density, continuity equation, steady current.

2.2 Dielectrics-concept of polarization, the relation D=e0E+P, Polarizabilty, Electronic polarization and polarization in monoatomic and polyatomic gases. [3L]

Module 3
Magnetostatics & Time Varying Field
3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form. [3L]

Module 4
Electromagnetic Theory
4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector. [6L]

Module 5
Quantum Mechanics
5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. [4L]
Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrodinger's equation, formulation of time independent Schrodinger's equation by method of separation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, Application of Schrodinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. [9L]

Module 6:
Statistical Mechanics:
6.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero ofemperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation. [7L]