

**PHYSICS**

**1. Electromagnetic Theory**

Electrostatics: Gauss' Law and its applications; Laplace and Poisson equations, boundary value problems; Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction; Maxwell's equations in free space and linear isotropic media; Scalar and vector potentials; Electromagnetic waves in free space, dielectrics, and conductors; various Optical phenomena; Dynamics of charged particles in static and uniform electromagnetic fields

**2. Quantum Mechanics**

Wave-particle duality; Schrodinger equations; particle-in-a-box, harmonic oscillator; Tunneling through a barrier; Motion in a central potential; Orbital angular momentum, Angular momentum algebra, spin; Addition of angular momenta; Hydrogen atom, spin-orbit coupling, Time-independent perturbation theory and applications; Time dependent perturbation theory and Fermi's Golden Rule; Selection rules; Semi-classical theory of radiation

**3. Statistical Physics**

Classical and quantum statistics, ideal Fermi and Bose gases; Principle of detailed balance; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation

**4. Semiconductor Physics and Electronics**

Semiconductor device physics, diodes, transistors, field effect devices, homo and heterojunction devices, device structure, device characteristics, frequency dependence and applications; Optoelectronic devices, High-frequency devices, Operational amplifiers and their applications; Digital techniques and applications, A/D and D/A converters, optical sensors

**5. Atomic & Molecular Physics**

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance; Physics of Lasers, stimulated emission, optical resonator, excimer lasers

**6. Condensed Matter Physics**

Bravais lattices; Reciprocal lattice, diffraction and the structure factor; Bonding of solids; Elastic properties, phonons, lattice specific heat; Free electron theory and electronic specific heat; Relaxation phenomena; Drude model of electrical and thermal conductivity; Fermi's Golden rule, Hall effect and thermoelectric power; Types of magnetism ; Electron motion in a periodic potential, band theory solids; Superconductivity, type - I and type - II superconductors, Josephson junctions, BCS theory, London equations

**7. Physics of Nanomaterials:**

Introduction – Nanoscale; Nanomaterials: Methods for synthesis of nanomaterials, Properties of nanomaterials – Electrical, Magnetic, Optical, Mechanical, Characterization techniques – X ray Diffraction (XRD), Electron Microscopies, Nanostructures (0D, 1D, 2D); Carbon nanotubes Characteristics and applications, Nanoelectronics and Nanoelectromechanical systems (NEMS), 2D nanomaterials and nanoparticle characteristics

Sd.

Dean Faculty of Science