Indian Institute of Information Technology, Allahabad

Department of Information Technology

Syllabus

Name of the Course: Engineering Physics (IT/ECE) L-T-P: 3-0-2

1. **Objective:**

- Demonstrate ability to collect, process, and analyze scientific data. Display critical thinking skills in applying physics knowledge in the experimental process.
- To impart knowledge in basic concepts of physics relevant to engineering applications.
- . To introduce advances in technology for engineering applications.

2. **Outcome:**

- To design and conduct simple experiments as well as analyze and interpret data in engineering applications
- Capability to understand advanced topics in engineering
- . Identify formulate and solve engineering problems
- Apply quantum physics to understand physics at atomic scale

3. **Course Plan**

Unit	Topics for Coverage
Unit 1	**Classical Mechanics:** Symmetry and conservation laws, Fermat's principle, Principle of least action, Euler Lagrange equations and its applications, Degrees of freedom, Constraints and constraint forces, Generalized coordinates, Lagrange's equations of motion, Generalized momentum, Ignorable coordinates, Concept of phase space, Hamiltonian, Hamilton's equations of motion and applications.
Unit 2	**Quantum Mechanics:** De Broglie's hypothesis. Uncertainty Principle, wave function and wave packets, phase and group velocities. Schrödinger Equation. Probabilities and Normalization. Expectation values. Eigenvalues and eigenfunctions. Infinite potential well and energy quantization. Finite square well, potential steps and barriers - notion of tunneling, Electron in periodic potential and band structure of solid.
Unit 3	**Solid State Physics:** Introduction, Energy Bands in conductors, semiconductors (intrinsic and extrinsic), insulators, Carrier transport in semiconductor (diffusion current, drift current) mobility and resistivity. Generation and recombination of carriers in semiconductors. and acceptors in the band model, electron effective mass, Density of states, Thermal equilibrium, Fermi-Dirac tion function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes. The n-p product and the intrinsic carrier concentration at extremely high and low temperatures, Variation of Fermi energy with doping concentration and temperature. Mechanism of carrier scattering, Einstein relationship between diffusion coefficient and mobility

6. Text Book:
Classical Mechanics:
Classical Mechanics; H. Goldstein, C. Poole, J. Safko.

Quantum Mechanics:
Introduction to Quantum Mechanics by D . J. Griffiths
Modern Physics by A. Beiser.

Solid State Physics
Physics of semiconductor devices, S M Sze, John Wiley & Sons, 2006.;

7. References:
Theoretical Mechanics by M. Spiegel.
Feynman Lectures of Physics Vol-1 and Vol-3.
Quantum Physics for Atoms, Molecules, Solids, Nuclei and Particles by R Eisberg and R. Resnick.
Modern Semiconductor Devices for Integrated Circuits, Chenming Hu