Syllabus of first year B Tech common courses, Department of Physics

PH101: Physics - I (2-1-0-6)

Calculus of variation: Fermat's principle, Principle of least action, Euler-Lagrange equations and its applications.

Lagrangian mechanics: Degrees of freedom, Constraints and constraint forces, Generalized coordinates, Lagrange's equations of motion, Generalized momentum, Ignorable coordinates, Symmetry and conservation laws, Lagrange multipliers and constraint forces.

Hamiltonian mechanics: Concept of phase space, Hamiltonian, Hamilton's equations of motion and applications.

Special Theory of Relativity: Postulates of STR. Galilean transformation. Lorentz transformation. Simultaneity. Length Contraction. Time dilation. Relativistic addition of velocities. Energy momentum relationships.

Quantum Mechanics: Two-slit experiment. 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.

Applications in one dimension: Infinite potential well and energy quantization. Finite square well, potential steps and barriers - notion of tunnelling, Harmonic oscillator problem zero point energy, ground state wavefunction and the stationary states.

Texts:

1. *Introduction to Classical Mechanics* by Takwale R and Puranik P (McGraw Hill Education, 1 st Ed., 2017).
2. *Classical mechanics* by John Taylor (University Science Books, 2005).
3. *Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles* by R. Eisberg and R. Resnick (John-Wiley, 2 nd Ed., 2006)

References:

1. *A Student's Guide to Lagrangians and Hamiltonians* by Patrick Hamill (Cambridge University Press, 1st edition, 2013).
2. *Theoretical Mechanics* by M. R. Spiegel (Tata McGraw Hill, 2008).
3. *The Feynman Lectures on Physics, Vol. I* by R. P. Feynman, R. B. Leighton, and M. Sands, (Narosa Publishing House, 1998).
4. *Introduction to Special Relativity* by R. Resnick (John Wiley, Singapore, 2000).
5. *Quantum Physics* by S. Gasiorowicz (John Wiley (Asia), 2000).

PH102: Physics - II (2-1-0-6)

Vector Calculus: Gradient, Divergence and Curl, Line, Surface, and Volume integrals, Gauss's divergence theorem and Stokes' theorem in Cartesian, Spherical polar and cylindrical polar coordinates, Dirac Delta function.

Electrostatics: Gauss's law and its applications, Divergence and Curl of Electrostatic fields,Electrostatic Potential, Boundary conditions, Work and Energy, Conductors, Capacitors, Laplace's equation, Method of images, Boundary value problems in Cartesian Coordinate Systems, Dielectrics, Polarization, Bound Charges, Electric displacement, Boundary conditions in dielectrics, Energy in dielectrics, Forces on dielectrics.

Magnetostatics: Lorentz force, Biot-Savart and Ampere's laws and their applications, Divergence and Curl of Magnetostatic fields, Magnetic vector Potential, Force and torque on a magnetic dipole, Magnetic materials, Magnetization, Bound currents, Boundary conditions.

Electrodynamics: Ohm's law, Motional EMF, Faraday's law, Lenz's law, Self and Mutual inductance, Energy stored in magnetic field, Maxwell's equations, Continuity Equation, Poynting Theorem, Wave solution of Maxwell Equations.

Electromagnetic waves: Polarization, reflection & transmission at oblique incidences.

Texts:

Introduction to Electrodynamics by D. J. Griffiths, , 3rd Ed., Prentice-Hall of India, 2005.

References:

1. *Engineering Electromagnetics* by N. Ida, Springer, 2005.
2. *Elements of Electromagnetics* by M. N. O. Sadiku, Oxford, 2006.
3. *The Feynman Lectures on Physics, Vol.II* by R. P. Feynman, R. B. Leighton and M. Sands, Narosa Publishing House, 1998.
4. *Electromagnetism* by I. S. Grant and W. R. Phillips, John Wiley, 1990.