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

Prerequisite: Nil

Calculus of variation: Fermats 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. Schrodinger 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. R. Takwale and P. Puranik, Introduction to Classical Mechanics, 1st Edition, Mc-Graw Hill Education, 2017.
2. John Taylor, Classical mechanics, University Science Books, 2005.
3. R. Eisberg and R. Resnick, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, 2nd Edition, John-Wiley, 2006.

References:

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