

7. Courses Description

Core Courses

PHY 601 - Classical Mechanics

Course Code & Number	Course Name	C.H.	Lec.	Lab.	Tut.
PHY 601	Classical Mechanics	4	4	0	0

Syllabus

Survey of the Elementary Principles: *Mechanics of a particle, Mechanics of a system of particles, Constraints, D'Alembert principle and Lagrange's equations, Velocity-dependent potentials and the dissipation function, Simple applications of the Lagrangian formulation.*

Variational Principles and Lagrange's Equations: *Hamilton's principle, Derivation of Lagrange's equations from Hamilton's principle, Variational principle formulation, Conservation theorems and symmetry properties.*

The Central Force Problems: *Reduction to the equivalent one-body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classical orbits, The Virial theorem, The differential equation for the orbit.*

The Kinematics of Rigid Body Motion: *The independent coordinates of a rigid body, Orthogonal transformations, Formal properties of the transformation matrix, The Euler angles, The Cayley-Klein parameters, Euler's theorem on the motion of a rigid body, Finite rotations, Infinitesimal rotations, Rate of change of a vector, The Coriolis effect.*

The Rigid Body Equations of Motion: *Angular momentum and kinetic energy of motion, Tensors, The inertia tensor and the moment of inertia, The eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and the Euler equations of motion, Torque-free motion of a rigid body, The heavy symmetrical top.*

Oscillations: *Formulation of the problem, The eigenvalue equation and the principal axis transformation, Frequencies of free vibration and normal coordinates, Forced vibrations.*

The Hamilton Equations of Motion: *Legendre transformations and the Hamiltonian equations of motion, Cyclic coordinates and conservation theorems, Derivation of Hamilton's equations from a Variational principle, The principle of least action.*

Canonical Transformations: *The equations of canonical transformation, Examples of canonical transformations, The harmonic oscillator, Poisson brackets and other canonical invariants, The angular momentum Poisson bracket relations.*

References

- H. Goldstein, C.P. Poole, J. Safko, Classical Mechanics, 3rd Edition, Addison-Wesley, 2001.
- L.D. Landau, E.M. Lifshitz, Mechanics, 3rd Edition, Butterworth-Heinemann, 1976.
- S.T. Thornton, J.B. Marion, Classical Dynamics of particles and Systems, 5th Edition, Thomson Learning, 2004.

