Physics – 1 PH-111, MECHANICS & THERMODYNAMICS

Mechanics

Vectors and Kinematics:
Vectors, linear independence, completeness, basis, dimensionality, inner products orthogonality. Displacement, derivatives of a vector. Velocity, acceleration. Kinematic equations, motion in plane polar coordinates
(4 hrs)

Newtonian Mechanics:
Momentum, Force, Newton's Laws, Applications. Dynamics of a system of particles, conservation of momentum, impulse, center of mass.
(4 hrs)

Work and Energy:
Integration of the equation of motion, Work energy theorem, applications. Gradient operator - potential energy and force - interpretation. Energy diagrams. Non conservative forces. Law of conservation of energy, power, particle collisions.
(4 hrs)

Rotations:
Angular momentum - torque on a single particle. Moment of inertia. Angular momentum of a system of particles. Pure rotation about an axis - the physical pendulum
(6 hrs)

Central Force Motion:
Central force motion of two bodies. Relative coordinates - reduction to one dimensional problem.Spherical symmetry and conservation of angular momentum - consequences. Planetary motion and Kepler's laws.
(6 hrs)

Hormonic Oscillator:
1-D hormonic oscillator. Damped and forced harmonic oscillators - solutions
(3 hrs)

Thermodynamics

Zeroth law of thermodynamics - Temperature - measurement and scales - Thermal expansion - Heat and work - First law of thermodynamics - Heat transfer mechanisms – Irreversible processes and Entropy - Change in Entropy - Second law of thermodynamics - Heat engines
(12 hrs)

Textbooks:

An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow
Cambridge University Press (2010)

Heat and Thermodynamics, M. W. Zemansky, McGraw Hill Pub.(1997)