Physics I
Syllabus

I. Physical Quantities, Scalars, and Vectors
   A. Physical quantities and SI units
   B. Dimensional analysis
   C. Problem solving method
   D. Accuracy, precision, and uncertainty
   E. Significant figures, error propagation, and scientific notation
   F. Scalar quantities, vectors, and unit vectors
   G. Vector addition and subtraction
   H. Vector dot product and cross product

II. Linear Motion
   A. Position, displacement, velocity, and acceleration
   B. Kinematic equations for constant acceleration
   C. Motion graphs
   D. Velocity and position by integration for varying acceleration
   E. Free fall motion and projectile motion
   F. Reference frames and relative velocity

III. Forces and Newton's Three Laws of Motion
   A. Types of forces
   B. Free body diagrams
   C. Newton's three laws of motion
   D. Terminal speed
   E. Uniform circular motion and radial acceleration

IV. Work, Kinetic Energy, and Potential Energy

A. Work and kinetic energy
B. Gravitational and elastic potential energies
C. Work-energy theorem
D. Conservative and non-conservative forces
E. Conservation of energy
F. Average and instantaneous power
G. Force and potential energy relationship

V. Linear Momentum and Collisions

A. Linear momentum and net force
B. Impulse and the impulse-momentum theorem
C. Momentum changes in colliding bodies
D. Conservation of momentum in collisions
E. Elastic, inelastic, and perfectly inelastic collisions
F. Center of mass and center of gravity
G. Rocket propulsion

VI. Rotation of Rigid Bodies

A. Angular position, displacement, velocity, and acceleration
B. Relating angular and linear variables
C. Radial and tangential acceleration
D. Uniform and nonuniform circular motion
E. Kinematic equations for constant angular acceleration
F. Angular velocity and position by integration for varying acceleration
G. Rotational inertia and its derivations
H. Parallel-axis theorem

VII. Torque, Rotational Energy, and Angular Momentum

A. Torque and Newton's laws of motion in terms of rotation
B. Static equilibrium
C. Work, kinetic energy, and power in rotation
D. Rolling bodies and total kinetic energy
E. Angular momentum and the conservation of angular momentum

VIII. Elasticity

A. Stress and strain
B. Elastic moduli and Hooke's law
C. Stress-strain diagrams

IX. Fluids

A. Static and dynamic fluids
B. Density
C. Pressure and Pascal's law
D. Buoyancy force and Archimedes's principle
E. Surface tension
F. Continuity equation
G. Bernoulli's equation

X. Periodic Motion

A. Periodic motion and restoring forces
B. Amplitude, period, frequency, and angular frequency
C. Simple harmonic motion (SHM)
D. Position, velocity, acceleration, and amplitude in SHM
E. Mechanical energy in SHM
F. Simple and physical pendulums

XI. Mechanical Waves

A. Transverse and longitudinal waves
B. Wave function, velocity, and acceleration of wave particles
C. Speed of mechanical waves
D. Power and intensity of mechanical waves
E. Wave interference and superposition
F. Standing waves on a string
G. Normal modes of a string fixed at both ends

XII. Sound and Hearing

A. Sound waves
B. Sinusoidal sound waves
C. Loudness, pitch, timbre, and noise
D. Speed of longitudinal waves in gases, liquids, and solids
E. Sound intensity
F. Standing sound waves and normal modes
G. Resonance and resonance curves
H. Sound wave interference
I. Beats
J. Doppler effect