Part IA — Intro to Mechanics

Based on lectures by Dr P. J. O'Donnell

Notes taken by Marcus Ng

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The lecture list is taken directly from the course schedule. However, it has been shortened to 8 lectures for this session.

Lecture 1
Brief introduction

Lecture 2: Kinematics of a single particle
Position, velocity, speed, acceleration. Constant acceleration in one-dimension. Projectile motion in two-dimensions.

Lecture 3: Equilibrium of a sinle particle
The vector nature of forces, addition of forces, examples including gravity, tension in a string, normal reaction (Newton's third law), friction. Conditions for equilibrium.

Lecture 4: Equilibrium of a rigid body
Resultant of several forces, couple, moment of a force. Conditions for equilibrium.

Lecture 5: Dynamics of particles
Newton's second law. Examples of pulleys, motion on an inclined plane.

Lecture 6: Dynamics of particles
Further examples, including motion of a projectile with air-resistance.

Lecture 7: Energy
Defintion of energy and work. Kinetic energy, potential energy of a particle in a uniform gravitational field. Conservation of energy.

Lecture 8: Momentum
Definition of momentum (as a vector), conservation of momentum, collisions, coefficient of restitution, impulse.

Lecture 9: Springs, strings and SHM
Force exerted by elastic sptings and strings (Hooke's Law). Oscillations of a particle attached to a spring, and of a particle hanging on a string. Simple harmonic motion of a particle for small displacement from equilibrium.

Lecture 10: Motion in a circle
Derivation of the central acceleration of a particle constrained to move on a circle. Simple pendulum; motion of a particle sliding on a cylinder.

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