

# PHYSICS 1A / HIGHER PHYSICS 1A/(SPECIAL) HIGHER PHYSICS 1A (PHYS1121/PHYS1131/PHYS1141)

**Textbook:** 'Fundamentals of Physics', Halliday & Resnick 10<sup>th</sup> Edition

## **TOPIC 1: Mechanics**

- **MOTION ALONG A STRAIGHT LINE** (§2.1 – 2.6)  
Displacement, velocity and acceleration; motion with constant acceleration. (Much of this will be assumed knowledge with revision resources supplied.)
- **VECTORS** (§3.1 – 3.3 )  
Vectors; resolution and unit vectors; vector addition; dot and scalar products
- **MOTION IN TWO AND THREE DIMENSIONS** (§4.1 – 4.7)  
Equations of motion in vector form; average and instantaneous velocities and accelerations; projectile motion; uniform circular motion; relative motion.
- **FORCE AND MOTION** (§5.1 - 5.3, 6.1 – 6.3)  
Newton's laws of motion; mass; contact forces (normal and frictional components); dynamics of circular motion. Applications of all of these in mechanics.
- **WORK AND ENERGY** (§7.1 – 7.6, §8.1 – 8.5)  
Mechanical work; vector dot product; variable forces inc. Hooke's Law. Kinetic energy and the work-energy theorem; potential and internal energies, power.
- **CENTRE OF MASS AND LINEAR MOMENTUM** (§9.1 – 9.8)  
Extended objects and many particle systems, centre of mass; linear momentum; collisions in 1 and 2 dimensions.
- **ROTATION AND TORQUE** (§10.1 – 10.8, §11.1-11.8)  
Angular velocity and acceleration; rotational kinetic energy; moment of inertia; torque, rotational kinematics and mechanics. *Note: Parts of this section will be covered in the lab and problem solving classes and may not be covered in lectures. They are examinable.*
- **GRAVITATION** (§13.1 – 13.3, 13.5 – 13.7)  
Newton's law of gravitation; Gravitation, g and its variation; the Principle of Superposition; Gravitational Potential Energy; Kepler's laws; motion of planets and satellites.

<b>TOPIC 2: Thermal Physics</b>
<ul style="list-style-type: none"> <li>• <b>TEMPERATURE</b> (§18.1 – 18.3) Heat, temperature and thermal equilibrium; absolute zero; thermal properties of matter; measuring temperature, specific and latent heats.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>KINETIC THEORY OF GASES</b> (§19.1 – 19.9) Macroscopic properties of a gas and the ideal gas law; molecular model of the ideal gas; kinetic interpretation of temperature; mean free path; the distribution of molecular speeds; molar specific heats; adiabatic processes; equipartition of energy.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>HEAT AND THE FIRST LAW OF THERMODYNAMICS</b> (§18.4 – 18.6) Energy transfer mechanisms in thermal processes; work and internal energy; work and heat in thermodynamic processes; the First Law of Thermodynamics.</li> </ul>

<b>TOPIC 3: Waves</b>
<ul style="list-style-type: none"> <li>• <b>OSCILLATIONS</b> (§15.1 – 15.6) Oscillating systems; Simple Harmonic Motion, including energy of oscillations; Examples, including uniform circular motion, pendulums; Damped and forced oscillations (qualitative only).</li> </ul>
<ul style="list-style-type: none"> <li>• <b>WAVE MOTION</b> (§16.1 – 16.5, 16.7) Propagation of a disturbance; travelling waves; wave speed; reflection and transmission; power and intensity in wave motion; the principle of superposition; interference of waves; standing waves.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>SOUND WAVES</b> (§17.1 – 17.8) The speed of sound; pressure variations; travelling longitudinal waves; power, intensity and level of sound waves; interference; the Doppler effect; resonance; standing longitudinal waves; beats; shock waves</li> </ul>

Weeks 1-6: Mechanics

Weeks 7-12: Thermal Physics; Waves