PHYSICS

(Year 11 and 12)

Unit A: Linear Motion and Waves

A1: Linear motion and force

- Uniformly accelerated motion (displacement, speed, velocity and acceleration)
- Vectors Representations (graphs), equations of motion
- Vertical motion
- Newton's Three Laws of Motion and application of the forces
- Momentum
- Energy (kinetic, potential), conservation
- Collisions (elastic and inelastic)

A2: Waves

- Waves (Longitudinal and transverse waves)
- Describing waves - period, amplitude, wavelength, frequency and velocity
- Mechanical waves, mechanical wave model (reflection and refraction)
- Superposition of waves, standing waves, interference phenomena, standing waves in pipes and on stretched strings
- Resonance and transfer of energy
- Light wave properties, ray model of light, reflection, refraction and image formation from lenses and mirrors
- Wave model, reflection, refraction, total internal reflection, dispersion, diffraction and interference, a transverse wave model, polarisation
- Speed of light, speed of mechanical waves, intensity

Unit B: Thermal, Nuclear and Electrical

Unit B1: Thermal (Heating Processes)

- Heat transfer - conduction, convection and/or radiation
- Kinetic particle model
- Thermal energy
- Temperature - average kinetic energy
- Heat capacity of the substance
- Internal energy, latent heat
- Thermal equilibrium

- Work done and internal energy
- Conservation of energy
- Energy transfers and transformations in mechanical systems *e.g.* internal and external combustion engines, electric motors

Unit B2: Nuclear

- Nuclear model of the atom, mass, protons, neutrons and electrons
- Nuclear stability
- Alpha, beta and gamma radiations and energy
- Half-life
- Einstein's mass/energy relationship
- Alpha and beta decay
- Neutron-induced nuclear fission
- Fission chain reaction, thermal energy
- Nuclear fusion and the release of energy
- Nuclear fusion v/s fission

Unit B3: Electrical

- Electrical circuits
- Electric current, discrete charge carriers
- Energy in an electrical circuit
- Electric potential difference
- Charge carriers, current in circuits
- Power
- Resistance for ohmic and non-ohmic components
- Circuit analysis and design – pd, current, and the power supplied to, components in series, parallel and series/parallel circuits

Unit C: Gravity and Electromagnetism

Unit C1: Gravity and motion

- Free-falling bodies in Earth's gravitational field
- Newton's Law of Universal Gravitation
- Field theory attributes of gravitational force
- Potential energy and work done on or by the field
- Gravitational field strength
- Vector nature of the gravitational force

- Projectile motion
- Circular motion on a horizontal plane and around a banked track
- Kepler's laws of planetary motion and satellites,
- Uniform circular motion

Unit C2: Electromagnetism

- Electrostatically charged objects and Coulomb's Law
- Point charges and electric field
- Electric field strength
- Potential energy and work is done by the field
- Current-carrying wires and magnetic fields (solenoids and electromagnets)
- Magnetic flux density
- Force in a magnetic field (DC electric motors)
- Magnetic flux density and area
- Electromagnetic induction - transformers, DC and AC generators, and AC induction motors
- Conservation of energy, Lenz's Law of electromagnetic induction, induced current
- Electromagnetic waves
- Frequency of the wave

Unit D: Revolutions in Modern Physics

Unit D1: Special Relativity

- Objects travelling at very high speeds (for example, high-speed muons created in the upper atmosphere, and the momentum of high speed particles in particle accelerators)
- Einstein's special theory of relativity, velocities approaching the speed of light
- Special theory of relativity and two postulates
- Motion, length and time are relative quantities that depend on the observer's frame of reference
- Relativistic momentum, high relative speed
- Concept of mass-energy equivalence and energy produced in nuclear reactions

Unit D2: Revolutions in Modern Physics

- Atomic phenomena and discrete values
- Electromagnetic radiation, photons, Planck's constant (for example, from the photoelectric effect or the threshold voltage of coloured LEDs)
- Black body radiation and the photoelectric effect, light quanta

- Spectral analysis
- The Bohr model and atomic energy-level diagrams
- Characteristics energy and matter - waves and particles (for example, Young's double slit experiment)

References:

1. For full details about any ACT curriculum, please refer to ACT Board of Senior Secondary Studies (BSSS Courses); http://www.bsss.act.edu.au/curriculum/courses