

PHYSICS 1B / HIGHER PHYSICS 1B (PHYS1221/PHYS1231)

Textbook: 'Physics for Scientists and Engineers with Modern Physics', Serway & Jewett, 7th Edition, ISBN-13: 978-0-495-11245-7

TOPIC 1: Electricity and Magnetism

- ELECTROSTATICS (§23.1, 23.3-23.6)
Electric charge. Electric force: Coulomb's law. Electric field, **E**. Electric field lines. Calculation of **E** for charge distributions.
- GAUSS'S LAW (§24.1-24.4)
The flux of the electric field. Gauss's law and applications. Conductors in electrostatic equilibrium.
- ELECTRIC POTENTIAL (§25.1-25.6, 25.8)
Electric force, potential difference and electric potential energy. Potential for point charges. Equipotentials. Charge distributions. Van de Graff generator.
- CAPACITANCE AND DIELECTRICS (§26.1-26.5)
Capacitance and combination of capacitors. Energy storage. Dielectrics.
- MAGNETIC FIELDS AND MAGNETISM (§29.1-29.4)
Magnetism. The magnetic field, **B**; magnetic forces. Motion in uniform magnetic and electric fields. Force on current-carrying conductor.
- SOURCES OF THE MAGNETIC FIELD (§30.1-30.5)
Biot-Savart Law; applications. Force between current-carrying wires. Ampere's Law; applications. Magnetic field of wires, loops and solenoids. Magnetic flux and Gauss's law.
- FARADAY'S LAW, INDUCTION AND INDUCTANCE (§31.1-31.6, 32.1, 32.3)
Faraday's law of induction; motional emf and Lenz's law. Induced emf. Generators. Eddy currents and back emf. Inductance; self-inductance. Energy storage in a magnetic field.

TOPIC 2: Physical Optics
<ul style="list-style-type: none"> • <i>LIGHT (§34.7, 35.1-35.2, 35.4-35.8)</i> The electromagnetic spectrum; visible light; the speed of light; reflection, refraction and dispersion; Huygen's principle; total internal reflection.
<ul style="list-style-type: none"> • <i>INTERFERENCE (§37.1-37.6)</i> Double-slit interference; coherence; intensity in double-slit interference; phasors; phase-change on reflection; interference from thin films.
<ul style="list-style-type: none"> • <i>DIFFRACTION, GRATINGS AND SPECTRA (§38.1-38.4)</i> Single-slit diffraction; intensity in single slit diffraction; diffraction at a circular aperture; interference and diffraction combined. Multiple slits; diffraction gratings; resolving power.
<ul style="list-style-type: none"> • <i>POLARIZATION (§38.6)</i> Polarization; polarization by absorption, reflection, double refraction and scattering of light.

TOPIC 3: Introductory Quantum Physics and Solid State Physics
<ul style="list-style-type: none"> • <i>QUANTUM THEORY AND THE WAVE NATURE OF MATTER (§40.2, 42.3, 40.4, 40.5, 41.1, 41.2, 41.3, 42.4, 42.5, 40.6, 40.8)</i> Photoelectric Effect. The Bohr atom. Photons. The wave properties of particles; de Broglie's hypothesis. The wave function; square well; the hydrogen atom. Schrödinger equation; quantum numbers. Wave packets. Uncertainty Principle.
<ul style="list-style-type: none"> • <i>SOLID STATE PHYSICS (§43.4-43.7)</i> Free-electron theory of metals; band formation. Electrical conduction in metals and insulators. Semi-conductors.

Weeks 1-6: Electricity and Magnetism

Weeks 7-12: Physical optics; Introductory Quantum Physics & Solid State Physics.