

**PHYS1111 Fundamentals of Physics**  
**PHYS1149 Fundamentals of Physics (Aviation)**  
**PHYS0001 Fundamentals of Physics E**

**Handbook Entry**

This is an introductory level course in physics for students from all disciplines. The course will cover the methods of Physics, including the following topics: the description of motion; forces and momentum; the dynamics of particles; kinetic and potential energy; the conservation of energy; temperature and thermal equilibrium; specific and latent heat; thermal energy; fluids and fluid flow; oscillations and simple harmonic motion; waves, wave reflection and interference; the wave nature of light; electric fields and charge; electric potential and energy; electric currents; magnetism; electromagnetic induction and Faraday's law; early quantum theory and models of the atom; nuclear physics and radioactivity; nuclear energy.

**Course Text Book**

Physics, 7<sup>th</sup> Edition. J.D. Cutnell & K.W. Johnson, Publisher John Wiley & Sons Inc.

**Syllabus: Overview**

**Part A (Weeks 1-6)**

*18 x 1 hour lectures + Homework Problem Sets 1-3*

1. Introductory Concepts
2. Kinematics and Mechanics
3. Thermal Physics and Fluids
4. Waves and Light

**Part B (Weeks 7-12)**

*18 x 1 hour lectures + Homework Problem Sets 4-6*

5. Electrostatics and Electricity
6. Magnetism and Electromagnetic Induction
7. Atomic and Nuclear Physics

## Detailed Syllabus: Part A

Section Headings	Textbook Section No. (Cutnell & Johnson)	Page number in Cutnell and Johnson
<b>1. Introductory Concepts</b>		
SI Units, Standards	1.1, 1.2	1-5
Precision and uncertainty	Lecturer's notes and Lab 1	
Trigonometry. Vectors	1.4, 1.5-1.9	6-17
Area and volume, formulae	Appendix E	A4-A5
<b>2. Kinematics and Mechanics</b>		
Kinematics in one dimension (motion along a line): displacement, speed and velocity, acceleration	2.1, 2.2, 2.3	27-34
Equations of kinematics – constant acceleration. Applications of kinematics equations.	2.4, 2.5	34-43
Free fall under gravity	2.6	43-47
Kinematics in two dimensions. Equations.	3.1, 3.2	59-63
Projectile motion	3.3	65-74
Forces and Newton's laws: force and mass.	4.1	87-88
Newton's laws of Motion: Newton's First, Second and Third laws	4.2, 4.3, 4.5	88-92, 94-95
Gravity, forces of nature, mass and weight	4.7	96-99
Types of forces: normal force, tension	4.8, 4.10	100-102, 109
Friction: static and kinetic friction	4.9	103-107
Work and energy. Work-Energy Theorem. Energy conservation.	6.1, 6.2, 6.8	160-169, 182
Impulse and momentum. Conservation of Momentum	7.1, 7.2	196-205
<b>3. Thermal Physics and Fluids</b>		
Temperature and Heat. Temperature scales; Kelvin, Celsius, Fahrenheit	12.1, 12.2, 12.3	360-364
Thermal expansion: linear expansion, expansion of area, volume expansion.	12.4-12.5	364-371
Heat and internal energy. Specific heat. Latent heat and phase changes	12.6	371-372
Ideal fluids. Density, pressure, Variation of pressure with depth	11.1-11.3	321-327
Equation of continuity and Bernoulli's equation.	11.8-11.10	337-345
<b>4. Waves and Light</b>		
Simple harmonic motion (SHM). SHM and waves.	10.1, 10.2	286-293
Wave characteristics. Waves on strings example of transverse waves. Speed of wave on a string.	16.1-16.3	477-481
Wave speed and particle speed.	16.3	481
Mathematical description of waves.	16.4	481-482
Sound waves in air as example of longitudinal waves. Sound wave frequency, amplitude, wavelength, speed.	16.5, 16.6	482-487
Sound intensity.	16.7, 16.8	488-492
Electromagnetic waves, electromagnetic spectrum, light, speed of light.	24.1, 24.2, 24.3	753-761
Ray optics, reflection	25.1, 25.2	783-785
Light in transparent materials: Speed, frequency and wavelength. Refraction. Optical fibres.	26.1-26.2	807-812
Interference of light.	27.1-27.3	854-864
Diffraction of light.	27.5	865-869

## Detailed Syllabus: Part B

Section Headings	Section No.	Page No.
<b>5. Electrostatics and Electricity</b>		
The Origin of Electricity	18.1	537
Charged Objects and the Electric Force	18.2	538
Conductors and Insulators	18.3	540
Charging by Contact and by Induction	18.4	541
Coulomb's law	18.5	542
The Electric Field	18.6	547
Electric Field Lines	18.7	553
The Electric Field Inside a Conductor: Shielding	18.8	556
Potential Energy	19.1	573
The Electric Potential Difference	19.2	574
The Electric Potential Difference Created by Point Charges	19.3	580
Equipotential Surfaces and Their Relation to the Electric Field	19.4	583
Electromotive Force and Current	20.1	603
Ohm's Law	20.2	605
Resistance and Resistivity	20.3	607
Electric Power	20.4	610
<b>6. Magnetism and Electromagnetic Induction</b>		
Magnetic Fields	21.1	647
The Force That a Magnetic Field Exerts on a Moving Charge	21.2	649
The Motion of a Charged Particle in a Magnetic Field	21.3	652
The Force on a Current in a Magnetic Field	21.5	656
The physics of a direct-current electric motor	21.6	661
Magnetic Fields Produced by Currents	21.7	662
Induced Emf and Induced Current	22.1	686
Motional Emf	22.2	688
Magnetic Flux	22.3	692
Faraday's Law of Electromagnetic Induction	22.4	695
Lenz's Law	22.5	698
The Electric Generator	22.7	702
Transformers	22.9	711
<b>7. Atomic and Nuclear Physics</b>		
The Wave-Particle Duality	29.1	915
Blackbody Radiation and Planck's Constant	29.2	916
Photons and the Photoelectric Effect	29.3	917
The de Broglie Wavelength and the Wave Nature of Matter	29.5	926
Rutherford Scattering and the Nuclear Atom	30.1	939
Line Spectra	30.2	941
The Bohr Model of the Hydrogen Atom	30.3	942
De Broglie's Explanation of Bohr's Assumption about Angular Momentum	30.4	947
Nuclear Structure	31.1	975
The Strong Nuclear Force and the Stability of the Nucleus	31.2	977
The Mass Defect of the Nucleus and Nuclear Binding Energy	31.3	978
Radioactivity	31.4	981
Radioactive Decay and Activity	31.6	988
Radioactive Dating	31.7	990
Radioactive Decay Series	31.8	994
Biological Effects of Ionising Radiation	32.1	1004
Induced Nuclear Reactions	32.2	1008