HEC 105: Foundation Physics I

By
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Course name	**Foundation Physics I**
Course code	**HEC 105**
Level of course	Year 1, Semester 1
Credit units	4
Brief course description	Physics is the scientific search for the basic concepts, principles and laws that describe how our physical universe works. The purpose of this course unit is to gain some understanding of these basic laws and principles and to learn how to apply them to physical happenings that occur in our daily life and work. This first course will provide students with an in-depth introduction to Newtonian Mechanics, the study of motion and Properties of matter. The course will also help them understand how a given physical phenomena works so that, given an initial situation, you can predict what will happen next. The entire course will be delivered through a combination of theoretical lectures, problem-solving tutorials and laboratory-based practical. Laboratory sessions are expected to reinforce theory and also instill sound laboratory practices. Practical should enable students to increase their competence in numeracy, ICT, communication, teamwork and independent learning skills.
Objectives	This course is intended to: 1. To provide students with scientific knowledge about the basic laws and principles and to learn how to apply them in their respective undergraduate courses. 2. Demonstrate analytical and problem solving skills at the introductory level, as evidenced in elementary mechanics and thermodynamics. 3. Develop the ability of the students to conduct, observe, analyze and report an experiment. 4. Provide students with the ability to deal with physical models, mathematical formulas and solve numerical problems. 5. Enhance intellectual, communication and analytical skills of the students. 6. Enhance the ability of the students to seek, acquire and process data from different sources using the library and the internet.

Learning outcomes	After successful completion of this course, the students should be able to: 1. Demonstrate analytical and problem solving skills required to progress successfully into undergraduate study in engineering, physical and mathematical sciences. 2. Have the skills required to recognize and apply the concepts and principles of physics most relevant to a range of problems in the physical sciences and Engineering. 3. Have the practical skills required to do simple laboratory experiments. 4. Interpret the data from laboratory experiments in the context of relevant theories. 5. Should be able to acquire and process data from different sources using the library and the internet.
Mode of delivery	The course will be taught by using lectures, tutorials, Laboratories and assignments.
Mode of assessment	Coursework = 30% Examination = 70% Total =100%
Content	**WEEKS** **HOURS** **Week 1** **4 hours** 1. **Introduction:** SI units, dimensional Analysis, coordinate systems. 2. **Kinematics in one dimension:** displacement, speed, velocity and acceleration; linear motion with uniform acceleration and the equations of motion; gravitational acceleration. **Week 2** **4 hours** 1. **Vectors and scalars:** addition and subtraction of vectors; components of a vector. **2. Motion in more than one dimension:** projectiles. **Week 3** **4 hours** **Forces and Newton's laws of motion:** Force and mass; turning effects of forces, equilibrium of forces, Newton's 3 laws; gravitational force, normal forces, motion on an inclined plane, tension, frictional forces and coefficients of friction.

	Week 4 **4 hours** **Statics of rigid bodies:** Torque; action of forces and torques on rigid bodies; rigid bodies in equilibrium; centre of mass and centre of gravity; stability. **4 hours** **Week 6** **4 hours** 1. **Work, Energy and Power:** work done by a constant force; the work-energy theorem and kinetic energy; potential energy; conservative and nonconservative forces; conservation of mechanical energy; power. 2. **Linear momentum:** linear momentum, impulse and conservation of linear momentum; elastic and inelastic collisions in one and two dimensions. **Week 7** **4 hours** 1. **Uniform circular motion:** centripetal forces and centripetal acceleration; satellites. 2. **Rotational kinematics:** angular displacement, angular velocity and angular acceleration; the equations of rotational kinematics with constant angular acceleration; rolling motion. **Week 8** **4 hours** **Simple Harmonic Motion (SHM):** SHM of an ideal horizontal mass/spring system; rotating vector representation of SHM; kinetic and potential energy of a harmonic oscillator; examples of SHM; damped harmonic motion, gravity. **Week 9** **4 hours** **Elasticity:** Hooke's law; elastic moduli; stress and strain; Young's modulus; hysteresis, Energy stored in elastic model; Poisson's ratio; nonelastic behaviour. **Week 10** **4 hours** **Structure of matter:** phases of matter: solids, liquids, gases and plasmas; crystals; density; pressure;

	Week 11 **4 hours** **Fluids:** Fluids at rest; pressure; density; Archimedes' principle and flotation; Stokes's law and terminal velocity; hydraulic machines; fluids in motion: streamline flow; pressure within a fluid; Pascal's principle; Archimedes' principle and buoyancy; equation of continuity and Bernoulli's equation and their applications. **Week 12** **4 hours** **Temperature:** Temperature scales; thermometers; thermodynamic temperature and absolute zero; ranges of temperatures; quantity of heat; zeroth law of thermodynamics. Specific heat capacity, molar heat, Latent heat. **Week 13** **4 hours** **Thermal Expansion:** linear and volumetric expansion; solids and liquids; water. **Week 14** **4 hours** 1. **Gas Laws:** Boyle's Law, Charles's Law and Gay-Lussac's Law; equation of state and the ideal gas law. 2. **Kinetic Theory of Gases:** basic postulates; microscopic definition of temperature. **Week 15** **4 hours** 1. **Transfer of Thermal Energy:** radiation; convection; conduction. 2. **Thermodynamics:** basic concepts; first law of thermodynamics; conservation of energy; isothermal, isobaric, isometric and adiabatic processes; **Week 16 & 17** Examinations
Study materials	*1.* Halliday, Resnick and Walker (2013). Fundamentals of Physics, Wiley. *2.* James S. Walker (2007). "Physics" (International Edition). Pearson Education International. *3.* K. Johnson, S. Hewett, S. Holt, J. Miller (2014). "Advanced Physics for you", Nelson Thornes Ltd.