Course unit title:	Mechanics, Heat and Waves with Laboratory		
Course unit code:	APHY111		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor		
Year of study:	1		
Semester when the unit is delivered:	Fall and Spring		
Number of ECTS credits allocated :	5		
Name of lecturer(s):			
Learning outcomes of the course unit:	1. Describe with equations and graphically the motion along a straight line, the motion with constant acceleration and deceleration, and the motion due to gravity, distinguish and analyse motions to solve problems. 2. Explain and apply the Newton's Laws of motion to write the equations of motions, draw forces, solve problems by adding forces using free-body diagrams, and experimentally determine the acceleration due to gravity, investigate the Newton's Second Law, the factors effecting kinetic friction and force equilibrium. 3. Define and apply the concepts of work by a constant force, the kinetic energy, the potential energy due to the position and a spring, the work-energy principle, to solve problems with conservation of mechanical energy with/out dissipative forces, and experimentally determine the spring constant and investigate the conservation of mechanical energy. 4. Define the concept of linear momentum and its relation to forces, define the concept of impulse, explain the circumstances under which momentum is a conserved quantity, distinguish elastic and inelastic collisions, solve problems that involve elastic and inelastic collisions in one and two dimensions using the conservation of momentum and conservation of energy, and experimentally investigate the impulse and the conservation of linear momentum in elastic collisions. 5. Describe simple harmonic motion, apply conservation of mechanical energy on problems with simple harmonic oscillators, determine under what circumstances a simple pendulum resembles simple harmonic motion, calculate and experimentally investigate its period and frequency. 6. Define the concept of moments and the circumstances that a rigid body is in equilibrium, determine the rotation of a body about a fixed axis, calculate its torque, work, energy and power, and solve problems involving the principle of conservation of angular momentum. 7. Describe with equations and graphically the wave motion, define the types of waves and the concept of superposition (overlapping waves), describe the characteristics of sound waves, define Doppler effect, use the abovementioned terms and concepts to solve associated problems. 8. Describe the characteristics of ideal gas, determine under what circumstances the ideal gas law is valid, and solve associated problems using different temperature scales.		
Mode of delivery:	Face-to-face		
Prerequisites:	AMAT111 (or concurrently)	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Kinematics in one dimension:** Motion along a straight line, motion with constant acceleration and deceleration, graphical representations, motion with constant deceleration, motions due to gravity (free fall, fall with initial		

	velocity, objects thrown upward). • **Dynamics:** Newton's Laws of motion, type of forces, free-body diagrams, adding forces graphically, static and kinetic friction, inclines. • **Work and energy:** Work done by a constant force, kinetic energy, work-energy principle, potential energy due to position and due to a spring, conservation of mechanical energy, dissipative forces. • **Linear Momentum:** Momentum and forces, conservation of linear momentum in one and two dimensions, elastic and inelastic collisions, impulse, energy and momentum in collisions. • **Oscillations:** Simple harmonic motion, conservation of mechanical energy, simple pendulum. • **Rigid Body:** Moments, equilibrium of a rigid body, kinematics of a rigid body (motion and rotation about a fixed axis), dynamics of a rigid body (torque, work, energy and power in rotational motion, conservation of angular momentum). • **Waves:** Wave motion, superposition, sound waves, speed of sound, Doppler effect. • **Ideal gas:** density, ideal gas law, temperature scales. • **Laboratory Work:** General Laboratory Instructions and Error Analysis-Error bars are initially covered. Small group experiments on: Measurement of the Acceleration of Gravity, Force of Equilibrium, Newton's Second Law, Kinetic Friction, Conservation of Mechanical Energy, Conservation of Linear Momentum, Collision – Impulse, and Simple Pendulum.
Recommended and/or required reading:	
Textbooks:	D. Giancoli, ***Physics: Principles with Applications***, Prentice Hall, 6th Edition,2005
References:	• David Halliday, Robert Resnick, Jearl Walker, ***Fundamentals of Physics***, John Wiley & Son, 2001 • J. D. Cutnell, K. W. Johnson, ***Physics***, John Wiley & Sons, 2005 • A. Giambattista, B. McCarthy Richardson and R. C. Richardson, ***College Physics***, McGraw Hill, 2004
Planned learning activities and teaching methods:	Lectures are delivered to the students by means of computer presentations including images, simulations, and videos. Lecture notes and presentations are available through the web for students to be used in combination with the textbooks. Lectures begin with real-life observations challenging the students for explanation to guide them to the new physics concept and to investigate its principles and variables. Problems are presented and solved in the class while further problems are given for practice. Lectures are supplemented by eight laboratory exercises to investigate, test, and verify the taught physics principles, laws and methodologies.
Assessment methods and criteria:	• Tests: 20% • Laboratory Work: 20% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No