Course Title	Physics I				
Course Code	APHY111				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	1st / Fall and Spring				
Teacher's Name	Dr. Yiannis Parpottas, Dr. Theodoros Leontiou. Dr. George Chrysostomou				
ECTS	5	Lectures / week	3	Laboratories/week	1
Course Purpose	Various branches of engineering require a strong background in physics. The purpose of this course is to provide engineering students with the knowledge of the basic concepts and principles in mainly mechanics, also in heat and waves, so as to apply them in solving physics problems with applications to their branch of engineering as well as to perform related experiments.				
Learning Outcomes	By the end of the course, students must be able to: • Describe graphically and with equations the motion along a straight line, the motion with constant acceleration and deceleration, and the motion due to gravity, distinguish and analyze motions to solve problems. • Explain and apply the Newton's Laws to derive the equations of motions and solve problems by adding forces using free-body diagrams. • Experimentally, determine the acceleration due to gravity, investigate the Newton's Second Law, the kinetic friction and the force equilibrium. • Define and apply the concepts of work by a constant force, the kinetic energy, the potential energy due to the position and due to a spring, and the work-energy principle, to solve problems using conservation of mechanical energy with/out dissipative forces. • Experimentally, determine the spring constant, and investigate the conservation of mechanical energy. • Define the concept of linear momentum and its relation to forces, and the concept of impulse, and explain the circumstances under which momentum is a conserved quantity. • Distinguish elastic and inelastic collisions and solve problems that involve elastic and inelastic collisions in one and two dimensions using the conservation of momentum and conservation of energy • Experimentally, investigate the impulse, and the conservation of linear momentum in elastic collisions. • Define the concept of moments and the circumstances that a rigid body is in equilibrium and solve problems involving equilibrium of rigid bodies. • 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.				

<table>
<tr><td></td><td colspan="3">

- Describe the simple harmonic motion, apply conservation of mechanical energy to problems with simple harmonic oscillators.
- Determine under what circumstances a simple pendulum resembles simple harmonic motion, calculate and experimentally investigate its period and frequency.
- Describe graphically and with equations the wave motion, define the types of waves, describe the characteristics of sound waves, define Doppler effect, and use the abovementioned terms and concepts to solve associated problems.
- Describe the characteristics of ideal gas, determine under what circumstances the ideal gas law is valid, and solve associated problems using different temperature scales.

</td></tr>
<tr><td>Prerequisites</td><td>AMAT111 (or concurrently)</td><td>Corequisites</td><td>None</td></tr>
<tr><td>Course Content</td><td colspan="3">

<u>Theory</u>

- **Kinematics in one dimension:** Motion along a straight line, motion with constant acceleration and deceleration, graphical representations, 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.
- **Rigid Body:** Moments, statics (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).
- **Oscillations and waves:** Simple harmonic motion, conservation of mechanical energy, simple pendulum, wave motion, sound waves, speed of sound, Doppler Effect.
- **Ideal gas:** density, ideal gas law, temperature scales.

Laboratory

Before any experimental work, the Laboratory Instructions / Safety Rules as well as the topic of Error Analysis & Error Bars are covered. The experiments are performed in small groups (data collection and analysis, apply theory and draw conclusions, completion of laboratory report) related to the course syllabus, such as: Measurement of the Acceleration of Gravity, Force of Equilibrium, Newton's Second Law, Kinetic Friction, Conservation of

</td></tr>
</table>

	Mechanical Energy, Conservation of Linear Momentum, Collision – Impulse, and Simple Pendulum.
Teaching Methodology	Lectures are delivered to the students by means of computer presentations. Lecture notes and presentations are available through the course e-learning page to be used in combination with the suggested textbook and references. The course e-learning page is organized in distinct sections / modules with the actual presentations and a collection of problems. 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. During the lectures, the students are both encouraged to ask, and randomly be asked questions, to ensure that the proper level of understanding is accomplished. Lectures are supplemented by laboratory exercises. A laboratory manual provide the information for each exercise and guide the students, which are separated into small groups, to properly operate the apparatus, applying any safety rules, collect and analysis the data, and investigate / test / verify the taught physics principles / laws / methodologies. A laboratory assistant introduce the exercises to the students and provide further instructions or guidance, if needed, to the students.
Bibliography	**Textbook** D. C. Giancoli, *Physics: Principles with Applications*, Pearson, 7th Edition (Global Edition), 2016 **References** **1.** D. Halliday, R. Resnick, J. Walker, *Fundamentals of Physics: Extended*, Wiley, 11th Edition, 2018 **2.** J. D. Cutnell, K. W. Johnson, D. Young, S. Stadler, *Physics*, Wiley, 11th Edition, 2018 **3.** A. Giambattista, College Physics: With an integrated approach to forces and kinematics, McGraw-Hill Education, 5th Edition, 2019
Assessment	The evaluation of the course is performed by: (a) Two written mid-term exam during the semester, which examines specific modules of the course, and they account for 20% of the overall grade. (b) Laboratory reports and/or assignments during the semester. In the laboratory report students present the collected and analysed experimental data as well as their conclusions, derived from theory and experimental data. These account for 20% of the overall grade. (c) A written final exam, which examines all modules of the course, and it accounts for 60% of the overall grade. • Two Written Mid-Term Exams: 20% • Laboratory Reports/Assignments: 20% • Written Final Exam: 60% Students are prepared for the above written exams by presenting and solving selected problems in the class, so as the students to comprehend the method

	of solving these types of problems, understand in depth the concepts and place questions concerning these problems. In addition, problems are given to the students for further practice. Review sessions are also given to the students before each exam. In mid-term and final exams, the following are evaluated: (a) The comprehension of fundamental concepts / theory, (b) The capability of applying the theory, and equations, in solving simple problems, (c) The capability of applying the theory in solving problems, which require to use more than one concept or equation as well as investigation and/or quantification of equations. The means of evaluation are problems with elevated sub-questions, where all of the above three are examined, and they are weighted as follows: (a) 30%, (b) 30%, and (c) 40%, respectively. In the lab reports, the following are evaluated: (a) data collection, (b) data analysis, and (c) application of theory to draw conclusions. The evaluation of the above is weighted as follows: (a) 30%, (b) 40%, and (c) 30%.
Language	English