Course Title	Physics II				
Course Code	PHY112				
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 electromagnetism and optics 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: 1. Demonstrate graphically and calculate the forces applied on a charged particle by other charged particles, the electric field intensity and the electric potential due to several point charges at a particular point. 2. Describe and solve problems of charged particles moving in a uniform electric field. 3. Explain and apply the Gauss law to calculate the electric field intensity in problems where spherical or cylindrical or translational symmetry exists. 4. Define and calculate the electrostatic energy of charged capacitors with/out dielectrics. 5. Describe and experimentally investigate the resistance's and the Ohm's law variables. 6. Explain and experimentally measure the electromotive force. 7. Solve problems with circuits including several capacitors and several resistors, and experimentally investigate the equations in Wheatstone-Bridge and RC circuits. 8. Define, demonstrate graphically and calculate the magnetic field at a point due to one or more current-carrying wires (Biot-Savart law). 9. Define, demonstrate graphically and calculate the magnetic forces on two parallel/antiparallel current-carrying wires. 10. Calculate the induced EMF and current due to a changing magnetic flux, and solve problems related to the changing magnetic field and the induced electric field. 11. Explain reflection, internal reflection, Huygens's principle, polarization of light, solve problems, and experimentally demonstrate the laws of reflection and refraction. 12. Demonstrate the path of light rays in mirrors and thin lenses, and solve related problems.				

Prerequisites	AMAT111, APHY111	Corequisites	None
Course Content	**Theory** 1. **Electrostatics I:** Basic concepts of static electricity, atomic structure, insulators and conductors, induced charge, electroscope, Coulomb's law, electric field, field lines, and electric field intensity due to one or more point charges, Gauss's law. 2. **Electrostatics II:** Electric potential and potential difference, relation to electric field, equipotential lines and surfaces, electric potential due to point charges, motion of a point charge in a uniform electric field, capacitance, dielectrics, storage of electric energy. 3. **Dynamic Electricity:** Electric current, resistance and Ohm's law, resistivity, electric power, electromotive force (EMF), resistors in series and in parallel, capacitors in series and in parallel. 4. **Magnetism:** Magnets and magnetic fields, magnetic field at a point due to current (Biot-Savart law), force on an electric current in a magnetic field, magnetic field due to long straight current-carrying wire, force between two parallel/antiparallel current-carrying wires. 5. **Electromagnetic Induction:** Induced EMF, Faraday's law of induction; Lenz law, changing magnetic flux and electric field. 6. **Optics:** The ray model of light, reflection, index of refraction, Snell's law, total internal reflection and fiber optics, wave nature of light and polarization. 7. **Geometrical Optics:** Images formed by plane, convex and concave mirrors, thin lenses, ray tracing, optical instruments. **Laboratory** Perform experiments in small groups (data collection and analysis, apply theory and draw conclusions, completion of laboratory report) related to the course syllabus, such as: Electrostatic Charge (compare charging: contact vs induction), Ohm's Law (investigate its variables), Exploratory Study of Resistance (investigate its geometrical variables), EMF (determine the internal resistance and EMF of a battery), Resistances in Circuits (measure resistors in series and in parallel), Wheatstone Bridge (measure and calculate an unknown resistor), Capacitors in Circuits (measure resistors in series and in parallel), RC Circuits (investigate the charging of capacitors and of RC circuits), Law of Reflection (investigate the law), and Law of Refraction (measure index of refraction).		
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