Course unit title:	Electromagnetism and Optics with Laboratory		
Course unit code:	APHY112		
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		
Learning outcomes of the course unit:	1. Demonstrate graphically and calculate the forces experienced 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, describe and solve problems of charged particles motion in a uniform electric field. 2. Explain and apply the Gauss law to evaluate the electric field intensity in problems where spherical or cylindrical or translational symmetry exists. 3. Define the electrostatic energy of a charged capacitor with/out dielectrics, describe and experimentally investigate the resistance's and the Ohm's Law variables, explain and experimentally measure the electromotive force. 4. Develop skills to solve problems with circuits including several capacitors, several resistors, and resistors-capacitors, experimentally investigate the equations in Wheatstone Bridge and RC circuits, and experimentally demonstrate the Kirchhoff's Rules in electrical circuits. 5. Define, demonstrate graphically and calculate the magnetic field at a point due to one or more current carrying wires (Biot-Savart Law) and closed loop wires (Amperes Law), 6. Define, demonstrate graphically and calculate the magnetic forces on two current carrying parallel/antiparallel wires, and the path of a charged particle motion in a constant magnetic field. 7. Describe and experimentally demonstrate the laws of reflection and refraction, apply these laws graphically to light rays at plane and spherical surfaces (mirrors, thin lenses), and solve associated problems.		
Mode of delivery:	Face-to-face		
Prerequisites:	APHY111, AMAT122 (or concurrently)	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Review:** Basic concepts of electricity, atomic structure. • **Electrostatics:** Coulomb's Law, electric field intensity due to one or more point charges, electric potential, motion of a point charge in a uniform electric field. • **Further electrostatics:** Gauss Law and applications, capacitors and combination of capacitors, electrostatic energy of charged capacitors, dielectrics. • **Dynamic electricity:** Electric current, resistance and Ohm's Law, resistivity of conductors, combination of resistances. • **Direct Current Circuits:** Electromotive force (EMF), Kirchhoff's rules, power, potential across resistors, RC circuits. • **Magnetism:** Definition of magnetic field, magnetic field at a point due to current carrying wires (Biot-Savart Law) and closed loop wires (Ampere's		

	Law), magnetic forces on current carrying parallel/antiparallel wires, motion of a charged particle in a constant magnetic field. • **Optics:** The nature of light, measurement of the speed light, Huygen's principle, reflection, refraction, and polarization. • **Geometrical Optics:** Convex and concave mirrors, thin lenses, optical instruments. • **Laboratory Work:** Small group experiments on: Electrostatic Charge, Ohm's Law, Exploratory Study of Resistance, Resistances in Circuits, EMF, Kirchhoff's Rules, Resistor – Capacitor Network, Wheatstone Bridge, Law of Reflection, Law of Refraction.
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 ten 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