Course Title	**General Physics**				
Course Code	PHA102				
Course Type	Compulsory				
Level	BSc (Level 1)/ MPharm (Level 2)				
Year / Semester	1st / 1st Semester				
Teacher's Name	Dr. Yiannis Parpottas				
ECTS	6	Lectures / week	3	Laboratories/week	2
Course Purpose	Pharmaceutical Sciences, and in particular the Pharmaceutical Technology, the Physical Pharmacy and the Pharmaceutical Analysis, are sciences which require a strong background in Physics. The purpose of this course is to introduce and explain to students the physical phenomena related to pharmaceutical sciences, and explore the laws and equations that describe and quantify them.				
Learning Outcomes	By the end of the course, students must be able to: Mechanics • Explain Newton's laws and recognize forces in solids • Describe the motion in viscous fluids and solve related problems • Define the concepts of buoyancy, pressure and flow, explain the related physical principles and equations, and solve related problems • Describe Hooke's law and the elastic response of forces (e.g. biomaterials, viscoelasticity) • Explain the dynamics of circular motion • Recognize centrifugation as a technique in the pharmaceutical sciences Waves • Explain the oscillation coupling and wave propagation mechanism • Recognise and explain the wave parameters and type of waves • Describe the wave phenomena of reflection, refraction, diffraction, and interference Electricity • Explain the nature of electricity • Explain Coulomb's law and define the concepts of electric field, potential and electric potential energy • Describe the charge distribution in electric dipoles and atom polarization • Define and explain the function of capacitors and dielectrics and relate them with the function of cell membranes • Define and explain molecular electrical interactions • Define and describe separation techniques in the pharmaceutical sciences (e.g. electrolysis, electrophoresis)				

Magnetism

- Explain the magnetic properties of matter
- Define and explain the concept of magnetic field and the magnetic forces
- Describe the motion of charge in a magnetic field, and the technique used in mass spectrometers

Heat

- Recognize the thermal properties of matter
- Explain thermal equilibrium, thermal expansion and the heat transport mechanisms
- Define and explain the concept of internal energy, the properties of ideal gases, and solve related problems
- Explain the laws of thermodynamics, solve related problems in thermidometry, and demonstrate experimentally the conversion of electric to thermal energy

Optics

- Recognize and explain the optic phenomena of reflection, refraction, diffraction and interference, solve related problems and demonstrate experimentally calculation of the index of refraction
- Explain and draw the propagation of light through spherical mirrors and lenses
- Define and explain the physical principles in optical instruments used in the pharmaceutical sciences
- Explain the polarization of light, demonstrate experimentally and calculate the light intensity from two successive polarizers with different polarization axes

Atomic Physics

- Describe the structure of atom, explain the phenomena of excitation, de-excitation and ionization, and solve related problems
- Explain the physical principle of LASER, their characteristics and applications, and identify measures for protection
- Explain the physical principle and origin of X-rays, their characteristics and applications, the X-ray absorption factors and biological effects, identify measures for protection, describe the technique of X-ray diffraction
- Describe emission and absorption spectra, and describe applications of spectrometry in pharmaceutical sciences

Nuclear Physics

- Describe the structure of the nucleus, and recognise the emission of α, β, γ radioactivity
- Define and explain the concept of half-life of a radioactive nucleus
- Define isotopes and radiopharmaceuticals, and explain the use and mechanism of action (localization) of radiopharmaceuticals in nuclear medicine
- Recognize the biological effects of ionizing radiation, measures of radiation protection, and allowed doses of ionizing radiation

Prerequisites	None	Corequisites	None
Course Content	Theory • Mechanics: Newton's laws and forces in solids, motion in viscous fluids, buoyancy, pressure, flow, Hooke's law, elastic forces response, dynamics of circular motion, centrifugation in pharmaceutical sciences • Waves: oscillation coupling, wave propagation mechanism, wave parameters, type of waves, wave phenomena (reflection, refraction, diffraction, interference) • Electricity: nature of electricity, Coulomb's law, electric field, potential and electric potential energy, electric dipoles and charge distribution, capacitors and dielectrics (relate to cell membranes), molecular electrical interactions, separation techniques (e.g. electrolysis, electrophoresis) in pharmaceutical sciences • Magnetism: magnetic properties of matter, magnetic field and forces, motion of charge in magnetic field, mass spectrometers • Heat: thermal properties of matter, thermal equilibrium, thermal expansion, heat transport mechanisms, internal energy, ideal gases, laws of thermodynamics, thermidometry • Optics: optic phenomena (reflection, refraction, diffraction, interference), propagation of light rays through spherical mirrors and lenses, optical instruments in pharmaceutical sciences, light polarization, polarizers and polarization axes • Atomic Physics: structure of atom, atomic phenomena (excitation, de-excitation, ionization), LASER and X-rays (physical principles, characteristics, applications, measures for protection), X-ray diffraction, emission and absorption spectra, spectroscopy in pharmaceutical sciences • Nuclear Physics: structure of nucleus, radioactivity, half-life, isotopes, radiopharmaceuticals (use, mechanism of action), biological effects of radiation, radiation protection, dosimetry Laboratory experiments/exercises: As part of the course, laboratory exercises are carried out on the course material for a better deepening and consolidation of the theoretical part. Indicative exercises are: calculation of the index of refraction, light intensity through two successive polarizers with different axes of polarization, conversion of electric to thermal energy - thermidometry, etc.		
Teaching Methodology	Lectures are delivered to students by means of computer ppt presentations including images and simulations. Lecture notes and presentations are available through the web for students (e-learning) to use in combination with the suggested textbook and references. Lectures begin with observations of everyday life, challenging the students for explanations (discussions, questions/answers) to guide them to physics concepts/principles, and then proceed to applications, instruments and		

	techniques used in the pharmaceutical sciences. Related problems are presented and solved in the class and also are given to students for further practice. Laboratory work involves experiments conducted by small groups of students (collection and analysis of data, apply theory and draw conclusions, completion of laboratory reports).
Bibliography	(a) Textbook • 'University Physics with Modern Physics', Volume A' and B', H. D. Young και R. A. Freedman. Greek Translation: Papazisi (publisher), 3rd Edition, 2019 • "University Physics", H. D. Young και R. A. Freedman, Pearson Education edition. 14th ed, 2016 • "University Physics", H. D. Young και R. A. Freedman, Greek Translation by E. A. Dri et al., Athens, Volume A: 2009, Volume B: 2010, Volume C: 2012 (b) References **1.** 'Physics in Biology and Medicine', P. Davidovits, Greek Translation: Parisianou A. E. (publisher), 4th Edition, 2020 **2.** 'Physics of the Life Sciences', J. Newman, Greek Translation by K. Mpethani et al., Athens 2013 **3.** 'Physics of the Human Body', I. P. Herman, Greek Translation by B. Georgiou, Athens, 2009
Assessment	• Written Mid-Term Exam: 30% • Laboratory Reports: 20% • Written Final Exam: 50% The evaluation of the course is performed by (a) a written mid-term exam during the semester, which examines specific modules of the course and it accounts for 30% of the overall grade, (b) the laboratory reports during the semester, in which students present the collected and analysed experimental data as well as their conclusions, derived from theory and the experimental data, and it accounts for 20% of the overall grade, and (c) a written final exam, which examines all modules of the course, and it accounts for 50% of the overall grade. Students are prepared for the above written exams by solving problems, related to the field of pharmacy, in the class, while additional problems are given to the students for further practice. Frequent revisions are also performed to help students comprehend the various physical concepts and principles of techniques used in the field of study. In the mid-term and final exams, the following are evaluated: (a) The degree of understanding of the physical concepts, and the physical principles of techniques used in the pharmaceutical sciences. The means of evaluation are simple questions and simple exercises. (b) The application of theory in solving problems, which require to use more than one concept or equation as well as investigation and/or quantification of equations. The mean of evaluation are problems to solve. The evaluation of the above are weighted as follows: (a) 60%, (b) 40%.

	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%. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	Greek, English