PHYSICS IN PHARMACEUTICAL SCIENCES

Code number: NP18-02
Cycle: Undergraduate
Semester: 1st semester
Course type

X	Background/General knowledge
	Scientific area (pharmacy)

Credit Units (ECTS): 5
Lectures (hours/week): 4
Tutorial (hours/week):
Laboratory work (hours/week):
Course coordinator:
Eleni C. Paloura, Professor
Tutor (s):
Eleni C. Paloura, Professor
Office location: School of Science, 2nd Floor, Department of Solid-State Physics
Collaboration with students: During the Fall semester 2020-21 via e-mail, zoom and/or skype meetings
Communication (e-mail): paloura@auth.gr
Website: http://users.auth.gr/paloura
Maria Katsikini, Associate Professor
Office location: School of Science, 2nd Floor, Department of Solid-State Physics
Collaboration with students: During the Fall semester 2020-21 via e-mail, zoom and/or skype meetings
Communication (e-mail): katsiki@auth.gr
Website: http://users.auth.gr/katsiki

Assisting personnel: -
Aims of the course:
This course is addressed to 1st semester young pharmacy students. At the end of the course the students will have attained a working knowledge of fundamental principles of Classical and Modern Physics, their applications towards understanding functions of the human body and operation principles of certain diagnostic techniques. In addition to that, the students will have developed problem-solving skills.
Skills:
Basic knowledge of physics and applications in the human body as well in diagnostic methods.
Teaching methods: On-line Lectures using zoom (the zoom links are listed below)
Contents of the course:

- Nature of fundamental forces and application of laws of classical mechanics in the study of equilibrium of various parts of the human body as well as of the estimation the applied tension and compression.
- Properties of liquids and fundamental laws that govern their equilibrium and motion.
- Various cases of motion, e.g. oscillations.
- Waves in elastic media and sound waves, specific cases of electromagnetic waves e.g. light and X-rays.
- Properties and applications of ultrasonic waves, X-rays, laser light and optical fibers for diagnostic and therapeutical purposes.
- The concepts of work and energy, temperature and heat, energy interchange related with metabolism and energy balance in the human body.

- Fundamental concepts of bioelectricity and more specifically propagation of electrical signals in cells (mainly nervous cells) as well as fundamentals of diagnostic techniques based on bioelectricity (e.g. electro-cardiography, -myography, -encephalography).
- The concept of scaling in physics and its application in living organisms.
- Experimental data evaluation and assessment and measurement errors.

Proposed literature: (in greek)

- Essential University Physics (3rd edition), Wolfson Richard
- Principles & Practice of Physics, Mazur Eric
- Fundamentals of Physics, Halliday David, Resnick Robert et al
- Physics of the Life Sciences, Newman Jay

Educational activities: Lectures and problem-solving sessions

Evaluation process and methods: Assessment is via an on-line written final examination at the end of the semester. The platforms used are e-learning (it hosts the examination) and zoom (for supervision). The students are asked to answer a number of questions that include both theory and problems. The examination is 120 min long and the examination schedule is issued by the School of Pharmacy.

Use of TIC / Electronic distribution of the lectures

The lectures and the problem-solving sessions are based on the use of ICTs (Powerpoint) and the e-learning platform of AUTH. Copies of the lecture notes, the homework sets and all related announcements can be found in the e-learning page of the course (https://elearning.auth.gr/course/view.php?id=10402).

Teaching: Lecture attendance and problem-solving sessions

Calendar		
Lecture	**Title**	**Lecturer**
1	Introduction. Scaling in Physics.	M. Katsikini
2	Introduction to error analysis and graphical presentation of data, homework solutions.	E. C. Paloura
3	Newton's Laws for motion, equilibrium of point masses.	M. Katsikini
4	Types of forces (distant action and contact forces, gravitational, frictional and muscular forces).	M. Katsikini
5	Torque, center of mass, equilibrium of rigid bodies, the human body and its parts.	M. Katsikini
6	Problem solving (forces and torques)	M. Katsikini
7	Fluid mechanics I: definitions and characteristic properties of fluids, force, pressure, Pascal's principle and its applications.	E. C. Paloura
8	Fluid mechanics II: Archimedes principle, surface tension, adhesion and cohesion forces, capillary effects, surfactants.	E. C. Paloura
9	Fluid mechanics III: Fluid motion, viscosity, Bernoulli equation, laws of Poisseuille and Torricelli, Venturi tube, blood circulation, homework solutions.	E. C. Paloura
10	Work, energy, heat, principles of thermodynamics.	M. Katsikini
11	Energy needs of the human body, metabolism, homework solutions.	M. Katsikini

12	Heat I: Types of thermometers, thermometric scales and their applications, effects that accompany the temperature variations (contraction, expansion, phase transition), heat capacity and specific heat.	E. C. Paloura
13	Heat II: Mechanisms of heat propagation and applications, black body radiation and applications, homework solutions.	E. C. Paloura
14	Oscillations, simple and compound pendulum, walking legs as physical pendulum, normal walking rate.	M. Katsikini
15	Waves in elastic media, problem solution (oscillations, waves)	M. Katsikini
16	Sound waves I: definitions, frequency response of the human ear, mechanism and speed of sound propagation, intensity of sound.	E. C. Paloura
17	Sound waves II: audibility, sound intensity, properties and applications of ultrasound, concepts of acoustics.	E. C. Paloura
18	Sound waves III: beats, Doppler effect and applications, homework solutions.	E. C. Paloura
19	Optics I: nature of light**,** reflection and mirrors	M. Katsikini
20	Optics II: refraction of light, prisms, lenses and image formation	M. Katsikini
21	Optics III: Optical devices, human eye, use of lenses for the correction of refractive anomalies of the eye, simple and compound microscope.	M. Katsikini
22	Laser light and its applications, homework solutions.	M. Katsikini
23	X-rays I: Production of X-rays, Coolidge tube, continuous and characteristic line spectrum, Moseley's law.	E. C. Paloura
24	X-rays II: Mechanisms of X-ray interaction with matter. Absorption and protection from X-rays.	E. C. Paloura
25	X-rays III: X-ray detectors and applications, measurement units and impact of ionizing radiation, novel sources for X-ray generation. Homework solutions.	E. C. Paloura
26	Bioelectricity.	M. Katsikini

Lectures. Lectures (26 of 2 hours each) will take place via zoom.
Link for Prof. Katsikini :

https://authgr.zoom.us/j/94476327855?pwd=T2MwdVV1SmxBcXBwNEZvcEFsVWlYUT09

Link for Prof. Paloura:

https://authgr.zoom.us/j/92289195430?pwd=b21ZcWhXNWx3UG0vMkxxOFp5UXNpZz09

Laboratory work: -