University of Gdańsk

Subject card

Subject name and code	Physical Laboratory II Modern Physics and Biophysics, PG_00182166		
Field of study	Medical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Justyna Strankowska	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	45.0	0.0	0.0	45
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	45	0.0	55.0	100

Subject objectives	To familiarize students with the issues related to experiments in the context of problems formulated in the 20th and 21st centuries, with a special emphasis on physical phenomena and technical challenges in the medical environment. To present physics as a fundamental science for all natural sciences: medicine, chemistry, and biology. To provide a physical description of biological systems and an understanding of the structure and function of living matter. To introduce the physical principles of measurement methods used in modern physics and biophysics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[FIZMEDL3_U09] Can communicate effectively with colleagues and other employees, works in a team, including interdisciplinary teams, and manages his/her own and his/her colleagues' time appropriately.	The student plans the experiment's timeline and organises the workstation. They also discuss and verify tasks with their student team and lecturers while performing the experiments.	[SU2] presentation/project/paper/ report
[FIZMEDL3_U02] He can perform measurements of physical quantities, prepare, describe, and present the results of physical experiments, including the estimation of measurement uncertainties, and perform quantitative analyses and formulate qualitative conclusions based on them.	The student performs physical experiments based on 20th-century physical theories and the experiments that verify them. They can apply fundamental formulas in atomic, molecular, and nuclear physics. The student conducts measurements of physical quantities, describes and presents the results of experiments, analyses them, and draws conclusions based on knowledge of the structure of matter, the problem of wave-particle duality, the fundamentals of quantum mechanics, methods for describing living matter, types of interactions in living matter, and the principles of biophysics of cells, tissues, and organs. They know and understand the basics of research methods used to study biological systems and can perform experiments in this field.	[SU2] presentation/project/paper/ report
[FIZMEDL3_W09] Knows at an advanced level the construction and operating principles of measurement instruments, electronic systems, and diagnostic and therapeutic equipment used in physics research and in medical diagnosis and therapy.	Describes the structure and operating principles of measuring instruments and simple electronic circuits used during experiments.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[FIZMEDL3_W04] Knows and understands the role of a physical experiment and the elements of the theory of measurement uncertainty.	The student conducts physical experiments based on 20th-century physical theories and the experiments that verify them. They can apply fundamental formulas in atomic, molecular, and nuclear physics. The student measures physical quantities, describes and presents experiment results, analyses them, and draws conclusions based on knowledge of: the structure of matter; the problem of wave-particle duality; the fundamentals of quantum mechanics; methods for describing living matter; types of interactions in living matter; the basics of cell, tissue, and organ biophysics. They also know the fundamentals of research methods used to study biological systems and can perform basic experiments in this field.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[FIZMEDL3_U04] He can independently search for information in Polish and English professional and popular science literature, databases, and on the Internet, as well as from other sources. He can integrate and interpret this information, draw conclusions, and formulate opinions.	The student is able to independently search for, integrate, and interpret information from Polish and English-language professional literature and online databases to prepare for conducting experiments. They can also draw conclusions based on the collected data and formulate opinions regarding the phenomena being studied, which is the basis for a reliable description and evaluation of their own measurement results.	[SU2] presentation/project/paper/ report

Course outcome	Subject outcome	Method of verification
[FIZMEDL3_U08] Can prepare a written paper or presentation in Polish or English using specialised terminology in the field of physics and medical physics.	The student can independently prepare detailed reports on the experiments conducted. In their work, they correctly use specialised terminology from the fields of modern physics and biophysics.	[SU2] presentation/project/paper/ report
[FIZMEDL3_U10] Can independently plan and implement his/her own lifelong learning.	The student can independently plan and carry out the process of acquiring the theoretical knowledge needed to perform laboratory experiments. They understand that these skills form the basis for continuously and independently improving their professional qualifications after graduation.	[SU1] oral statement/conversation/ discussion

Subject contents

1. Optical simulation of a DNA radiograph.
2. Study of the physical properties of optical fibers.
3. Laser light diffraction on a slit and a circular aperture.
4. Analysis of radiographs.
5. Study of the intensity of characteristic X-ray radiation of copper (Cu) and molybdenum (Mo).
6. Study of the fluorescence of organic dyes. Substance identification based on their excitation and emission spectra.
7. Study of heart function using ECG and PCG (phonocardiography) methods.
8. Doppler anemometry.
9. Absorption spectra of polyatomic molecules.
10. Analysis of tissue images in an optical microscope and a scanning electron microscope.
11. Physical fundamentals of the magnetic resonance phenomenon.

Prerequisites and co-requisites

A. Formal Requirements: Completed lectures in Modern Physics and Biophysics of Biological Systems.

B. Prerequisites: Ability to process measurement results.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Raport	51.0%	50.0%
not applicable	51.0%	50.0%

Recommended reading

Basic literature	not applicable
Supplementary literature	not applicable
eResources addresses	

Example issues/ example questions/ tasks being completed

not applicable

Work placement

Not applicable

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