



Subject card

Subject name and code	Applications of physics in biology and medicine, PG_00051076						
Field of study	Technical Physics						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2029/2030	
Education level	first-cycle studies	Subject group				Optional subject group 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	4	Language of instruction				Polish	
Semester of study	7	ECTS credits				2.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Division of Atomic Molecular and Optical Physics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr Piotr Weber					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	Familiarization students with the functioning of living organisms in the context of physical phenomena. Familiarization with the techniques of measuring selected parameters describing a living organism. Familiarization with the methods of observation of selected structures and phenomena occurring in living organisms. Human-generated signal analysis						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_U02] is able to analyse and solve complex and non-standard scientific and technical problems using appropriate analytical, computational, numerical, simulation or experimental methods.		The student is able to perform preliminary numerical analysis of biological signals. The student has basic knowledge of the operation of equipment used in diagnostics.			[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information	
	[K6_W02] possesses structured knowledge of the fundamentals of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and molecular physics, solid-state physics, and nuclear and particle physics.		The student correctly uses terminology used in biophysics, biostatistics, and biochemistry. The student has basic knowledge of the structure and functioning of living organisms.			[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation	

Subject contents	Course content – lecture		
	<p>The lecture is divided into several parts, the topics of which present various applications of physics in biological and medical sciences. Among other things, theoretical applications are discussed - constituting a physicochemical background for the description of phenomena occurring at various levels of the internal structure of living organisms. At the same time, depending on the discussed part of the lecture, empirical methods used in the study of living systems and diagnostic tools are presented. The lecture consists of the following parts:</p> <ul style="list-style-type: none"> • Living organisms - structure and properties • Theoretical methods of describing biological molecules • Experimental methods of analyzing biological molecules • Biodynamics and metabolism • Electrical properties of living organisms • Biomechanics • Physical basics of selected methods of imaging tissues and organs • Statistics in biology and medicine • Signal analysis in biology 		
	Course content – laboratory		
	The computer laboratory focuses on developing programs for analyzing signals generated by living organisms. Computer programs are written in the Matlab environment. During the laboratory, students will learn selected signal analysis methods.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	two short tests (each 20 minutes) and one report	50.0%	40.0%
	Written exam; duration of the exam 60 minutes.	50.0%	60.0%
Recommended reading	Basic literature	J. P. Keener, J. Sneyd, "Mathematical Physiology", Springer, 1994	
	Supplementary literature	K. Sneppen, G. Zocchi, "Physics in Molecular Biology", Cambridge University Press, 2006	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<p>1. List the features of living organisms that you know and describe them. 2. Explain the concepts used in molecular biology: replication, transcription, translation. 3. What is ATP (adenosine triphosphate) and what role does it play in metabolism? 4. Describe the structure of nucleic acids. How is RNA different from DNA? What are its functions? 5. Describe the structure of phospholipids. What does it mean that phospholipids are amphiphiles? 6. What is the isoelectric focusing technique? 7. What is the metabolism of a living organism? Explain the concept of metabolic pathway.</p>		
Practical activities within the subject	Not applicable		

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