GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2025	Academic year of realisation of subject	2028/2029
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 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

Additional information:

The meeting with students takes the form of a traditional lecture with a presentation and a computer laboratory.

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] analyzes and solves simple scientific and technical problems, based on possessed knowledge, using analytical, numerical, simulation and experimental methods	The student is able to perform preliminary numerical analysis of biological signals.	[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
[K6_W02] has systematized knowledge of the basics of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and particle physics, solid-state physics, nuclear and elementary 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

<table>
<tr><td>Subject contents</td><td>Course content – lecture

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:

• Living organisms - structure and properties
• Theoretical methods of describing biological molecules
• Experimental methods of analyzing biological molecules
• Biotermodynamics and metabolism
• Electrical properties of living organisms
• Biomechanics
• Physical basics of selected methods of imaging tissues and organs
• Statistica 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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>exam</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>tests and reports</td><td>50.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>J. P. Keener, J. Sneyd, "Mathematical Physiology", Springer, 1994</td></tr>
<tr><td>Supplementary literature</td><td>K. Sneppen, G. Zocchi, "Physics in Molecular Biology", Cambridge University Press, 2006</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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