GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Biophysics, PG_00068209		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle 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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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 Brygida Mielewska	
	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	3.0	42.0	75

Subject objectives

To familiarize students with the issues of functioning of living organisms in the context of physical phenomena. Familiarizing them with techniques for measuring selected parameters and observing selected phenomena occurring in living organisms. Independent performance of measurements and development of measurement data

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	the student knows and understands the physical laws describing the transport of ions across the cell membrane and its consequences, the phenomena of transmission and perception of sound and electromagnetic waves by humans, and the influence of selected external factors on humans	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_U12] can analyze the operation of components, circuits and systems related to the field of study, as well as measure their parameters and examine technical specifications, and plan and conduct experiments related to the field of study, including computer simulations and measurements, and interpret obtained results and draw conclusions	the student independently or in groups performs experimental measurements and computer simulations illustrating biophysical phenomena, presents, and analyses the results	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

<table>
<tr><td>Subject contents</td><td>Course content – lecture
LECTURE: Cell biophysics: cell membrane structure, passive transport, active transport, sodium-potassium pump. Information transfer across the cell membrane, intra- and intercellular communication, hormones and neurotransmitters. Electrical model of the cell membrane, resting potential. Cell action potential. Propagation of a nerve impulse. Biophysics of the muscular system. Mechanics and energetics of muscle contractions. Transfer of excitation in smooth and striated muscle cells. Principles of geometric optics, examples and principles of operation of optical devices. Biophysics of the sense of sight: structure of the eye, Resolving power of the eye. Defects of the optical system of the eye. Color vision. Spatial vision. Biophysics of the sense of hearing: Structure and functioning of the auditory system. Features of sound. Perception of loudness and pitch of sounds. Localization of sound sources. Methods of testing hearing impairments, correction of hearing impairments. Biophysics of the sense of balance. The influence of mechanical factors on the body: Vibrations, infra- and ultrasound. Passive and active influence of ultrasound applications in diagnostics and therapy. The influence of accelerations on the human body. The influence of changed pressure on the living organism. Hypo- and hyperbaric, hyperbaric therapy.

Laboratory - laboratory exercises 1. Acoustic spatial orientation 2. Determining the human field of view 3. Measuring the temporal and spatial resolution of the human eye 4. Measuring the human hearing threshold curve 5. Examination of the properties of lenses and optical systems</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of thermodynamics, mass transport, flow, pressure, vibration and wave motion, wave optics</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>tests during the semester</td><td>0.0%</td><td>20.0%</td></tr>
<tr><td>written exam</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>laboratory excercises (tests and reports)</td><td>50.0%</td><td>30.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>University physics, ed. Openstax

Biophysics An Introduction Rodney M. J. Cotterill Danish Technical University, Denmark, ed. Wiley</td></tr>
<tr><td>Supplementary literature</td><td>Applied Biophysics A Molecular Approach for Physical Scientists Tom A. Waigh University of Manchester, Manchester, UK</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>Describe the structure and mechanism of acoustic impedance adjustment in the middle ear.

What is the mechanism of active transport across the cell membrane and what elements does it require?

What law is decompression sickness associated with and how can it be prevented or treated?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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