



## Subject card

Subject name and code	Biophysics, PG_00047801						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject				2022/2023	
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	4	ECTS credits				4.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr Brygida Mielewska					
	Teachers	dr inż. Marcin Dampc dr Brygida Mielewska dr inż. Ireneusz Linert					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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		4.0		51.0	100
Subject objectives	Student acquaints with problems of functioning of living organisms in the context of physical phenomena. Student gains skills of techniques of measurement of physical parameters and observation of processes typical for living structures. Student performs experiments and analyses obtained results.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W52] Knows and understands, to an advanced extent, selected aspects of chemistry and biochemistry, constituting general knowledge related to the field of study		student knows the theory and types of chemical bonds			[SW1] Assessment of factual knowledge	
	[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		student knows and understands selected physical laws of thermodynamics, fluid mechanics, waves, geometric optics and light wavea			[SW1] Assessment of factual knowledge	
	[K6_U07] can apply methods of process and function support, specific to the field of study		student applies experimental methods and computer simulations in measurements			[SU4] Assessment of ability to use methods and tools	
[K6_U05] can plan and conduct experiments related to the field of study, including computer simulations and measurements; interpret obtained results and draw conclusions		student applies experimental methods and computer simulations in measurements			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		

Subject contents	<p>LECTURE: Intra- and intermolecular forces Thermodynamic systems and processes. Thermodynamics of non-isolated systems. Equilibrium states. Streams. Biological systems as open thermodynamic systems. States of inequilibrium, Transport phenomena. Bioelectric phenomena, membrane potential, diffusion potential Thermodynamic description of chemical reactions, activation energy, kinetics of enzymatic reactions. Cells biophysics: cell membrane, active and passive transport, information flow through the cell membrane, intra- and intercellular communication hormones, neurotransmitters. Electrical model of cell membrane, resting potential, action potential, signal transduction. Biophysics of muscles. Activation transduction in smooth muscles and striated muscles. Mechanics and energetics of muscle contraction. Mechanics of biological liquids. Reological properties of blood. Biophysics of vision: structure of human eye, eye resolution Optical defects of the eye. Colour vision, stereoscopic vision. Biophysics of hearing: Structure of human ear. Sound perception: pitch, timbre and loudness. Localisation of sources of sound. Audiology, hearing corrections. Perception of balance. Biophysics of taste and smell. Influence of external factors on living organism: vibrations, infra- and ultrasounds. Influence of pressure: hypo- and hiperbaria, hiperbaric therapy. Influence of external fields: constant and low frequency fields High frequency fields and nonionising radiation. Physical processes in excited molecules. Photochemical reactions, photosensibilisation, phototherapy. Laser radiation, its influence and applications.</p> <p>Laboratory</p> <p>1. Acoustic orientation in space 2. Determination of visual field of human eye 3. Time-resolving capability of human eye 4. Electrophoretic mobility 5. Determination of diffusion potential</p>														
Prerequisites and co-requisites	Physics - elementary course Mathematics - differentials, integrals Chemistry - periodic system of the elements, chemical bonds, types of chemical reactions														
Assessment methods and criteria	<table border="1" data-bbox="448 837 1487 976"> <thead> <tr> <th data-bbox="448 837 794 875">Subject passing criteria</th> <th data-bbox="794 837 1141 875">Passing threshold</th> <th data-bbox="1141 837 1487 875">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 875 794 904">Laboratory</td> <td data-bbox="794 875 1141 904">50.0%</td> <td data-bbox="1141 875 1487 904">40.0%</td> </tr> <tr> <td data-bbox="448 904 794 934">Written exam test</td> <td data-bbox="794 904 1141 934">50.0%</td> <td data-bbox="1141 904 1487 934">40.0%</td> </tr> <tr> <td data-bbox="448 934 794 976">weekly quizzes</td> <td data-bbox="794 934 1141 976">50.0%</td> <td data-bbox="1141 934 1487 976">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory	50.0%	40.0%	Written exam test	50.0%	40.0%	weekly quizzes	50.0%	20.0%
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Recommended reading	Basic literature	1. Skrypt z materiałami do przedmiotu Biofizyka 2. Materiały do przedmiotu opracowane w formie edukacji na odległość, 3. Jaroszyk F. (pod red.), Biofizyka podręcznik dla studentów, Wydawnictwo Lekarskie PZWL 2006 4. Józwiak Z., Bartosz G., Biofizyka wybrane zagadnienia wraz z ćwiczeniami, PWN 2007 5. Piskunowicz P., Tuliszka M., Wybrane ćwiczenia laboratoryjne z biofizyki, Wydawnictwo Naukowe Uniwersytetu Medycznego, Poznań 2007													
	Supplementary literature	<p>1. Nałęcz M. (pod red.), Biocybernetyka i inżynieria biomedyczna 2000, t.1 Biosystemy, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2002</p> <p>2. Nałęcz M. (pod red.), Biocybernetyka i inżynieria biomedyczna 2000, t.2 Biopomiary, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2002</p> <p>3. Nałęcz M. (pod red.), Biocybernetyka i inżynieria biomedyczna 2000, t.9 Fizyka Medyczna, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2002</p>													
	eResources addresses	Adresy na platformie eNauczenie: BEEofizyka IBM 22/23 - Moodle ID: 26906 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=26906">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=26906</a>													
Example issues/ example questions/ tasks being completed	Describe thermodiffusion														
Work placement	Not applicable														

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