SUBJECT/COURSE SYLLABUS

1.	Course name in Polish and English **Medical Biophysics** Biofizyka medyczna
2.	Scientific discipline **Medical sciences** **Biotechnology**
3.	Language of instruction **English**
4.	Unit conducting the course **Faculty of Biotechnology**
5.	Type of course **elective - choice limited to Biophysics and bioenergetics and Medical Biophysics**
6.	Field of study **Biotechnology**
7.	Level of study **first-cycle**
8.	Year of study **2nd**
9.	Semester **summer**
10.	Course form and number of hours **Lecture: 30 h** **Laboratory: 30 h**
11.	Prerequisites in terms of knowledge, skills and social competences for the course: **LECTURE:** Understanding fundamentals of biology, chemistry and physics. **LABORATORY:** Basic knowledge about human cell biochemistry; ability to perform typical biochemical measurements.
12.	Learning objectives for the course: **LECTURE:** Understanding the physical background for processes in human body, learning application of biophysics in interpretation of medical data, understanding fundamentals for medical diagnosis and treatments using physical methods and physical factors **LABORATORY:** Learning basics of biophysical methodology to understand human body functioning at different levels; Gaining skills in obtaining various data, its presentation and interpretation.
13.	Curriculum content: **LECTURE:** **Biophysics at the organism level - man as a biological "machine":** • Generation of force by muscles, uniqueness of the heart muscle. • Interaction of the muscular and skeletal systems, loads and the development of pathologies.

	• Transmission of nerve signals, brain function. • Biophysics of hearing and vision processes. • Pulmonary and tissue respiration, oxygen transport by hemoglobin. • Fundamentals of fluid mechanics, biophysics of the circulatory system and lymphatic system. • Biophysics of the secretory system, renal filtration. • Electromagnetic radiation - effects on the body, therapeutic applications. • Ionizing radiation – physical properties, types, protection. • Selected imaging methods - USG, X-ray, CT, NMR, PET - physical basis, impact on the body. **Basics of medical molecular biophysics:** • Reactions that produce and consume energy, energy balance of the cell and the body. • Oxidation-reduction reactions - importance in biology. • Water and its role in biological phenomena. • Lipid biophysics, liquid crystal structures, phase transitions, monolayers, liposomes. Biological membranes - structure and function, integral and peripheral membrane proteins. • Transport through a biological membrane, diffusion, natural and induced permeability (ionophores and uncouplers). • Protein-catalyzed transport, symport, uniport, antiport. • Mitochondrial respiratory chain, complexes I, II and III. Cytochrome oxidase, proton pumping, ATP synthesis. **LABORATORY:** • Analysis of mitochondrial activity using polarography and microscopic methodologies. • Application of Fourier Transform Infrared Spectroscopy in analysis of skin, hair and other biological structures. • Analysis of diffusion processes within a living cell and in vitro. • Analysis of nerve conductivity and its modulation by different type of drugs (using computer simulation). • Analysis of environment with physical methods (loudness, intensity of magnetic field, intensity and quality of illumination) and its influence to human well-being. • Basic diagnostic methods using physical approach: measurement of pulse, measurement of blood pressure, analysis of speech, analysis of hearing range.	
14.	Description of learning outcomes **Student:** • makes a qualitative and quantitative description of the basic biological phenomena and processes; • have extensive knowledge in the field of biophysics; • knows the basic concepts, terms, techniques used in biophysics;	Symbols for relevant directional learning outcomes: **K1_W01** **K1_W04, K1_W05** **K1_W06**

	• reads and understands scientific literature in the field biophysics in English; • takes advantage of the online resources and literature to obtain information on biophysics; • is able to perform simple experiments under supervision; • can draw conclusions from experiments; • can critically analyze obtained results; • knows rules of safety work in the lab; • shows responsibility for carrying out experiments; • understands the need for continuing education throughout the whole life, including broadening knowledge in biophysics.	**K1_U03** **K1_U04** **K1_U01, K1_U05** **K1_W10** **K1_K03** **K1_K01**
15.	**Mandatory literature:** • Lab manual; **Recommended literature:** • **Cellular Mechanics and Biophysics.** Mierke, C. T. Springer International Publishing. 2020 • **Physics of the human body.** Herman, Irving P. Berlin, Heidelberg: Springer Berlin Heidelberg, 2007. • **Biophysics: An Introduction**, 2nd Edition. Roland Glaser; • **Molecular Biology of the Cell**. 6th Edition. Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter; • and other readings recommended during lectures**.**	
16.	Methods of verification of the assumed learning outcomes: **LABORATORY:** • entry test, lab report, final test **LECTURE:** • written exam (the condition for taking the exam is to obtain a positive grade in the laboratory classes)	
17.	Conditions and form of credit for individual components of the course: **LABORATORY:** • mandatory presence and active participation in the classes; • final test: multiple choice and open questions, 60% required to pass; • entry test: 2-4 questions; • lab report: analysis of results, presenting scientific data in the form of description, tables and figures **LECTURE:** • positive exam result; • active participation in the lectures	

18.	Student workload expressed in teaching hours and ECTS credits	number of hours allocated for the course of a given type of classes
	classes (according to the study plan) with the instructor: • **laboratory** (including introduction lecture, seminar and discussion sessions) • **lecture**	**30 h** **30 h**
	student's own work (including participation in group work) e.g.: • **preparation for the classes** • **reading the manual and literature indicated** • **writing a lab report** • **preparation for the final test** • **preparation for the exam**	**60 h**
	Total number of class hours:	**120 h**
	Number of ECTS credits: • **laboratory** • **lecture**	**3 ECTS** **2 ECTS**