



Syllabus for academic year: 2022/2023 Cycle: 2022/2023 – 2027/2028													
Description of the course													
Course	BIOFIZYKA							Group of detailed education results					
	BIOPHYSICS							Group of classes (group code) B	Group name sciences Basic medical Sciences				
Faculty	Faculty of Medicine												
Major	Medicine												
Level of studies	<input checked="" type="checkbox"/> uniform magister studies <input type="checkbox"/> 1 st degree studies <input type="checkbox"/> 2 nd degree studies <input type="checkbox"/> 3 rd degree studies <input type="checkbox"/> postgraduate studies												
Form of studies	<input checked="" type="checkbox"/> full-time <input type="checkbox"/> part-time												
Year of studies	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6						Semester:	<input checked="" type="checkbox"/> winter <input type="checkbox"/> summer					
Type of course	<input checked="" type="checkbox"/> obligatory <input type="checkbox"/> free choice / optional												
Language of study	<input type="checkbox"/> Polish <input checked="" type="checkbox"/> English												
Number of hours													
Form of education													
	Lectures (L)	Seminars (SE)	Auditorium classes (AC)	Major Classes – not clinical (MC)	Clinical Classes (CC)	Laboratory Classes (LC)	Classes in Simulated Conditions (CSC)	Practical Classes with Patient (PCP)	Foreign language Course (FLC)	Physical Education (PE)	Vocational Practice (VP)	Directed Self-Study (DSS)	E-learning (EL)
Winter semester:													
Department of Biophysics and Neuroscience													
Direct (contact) education ¹						33							
Distance learning ²	22												
Summer semester:													
..... (Dep. in charge of the course)													
Direct (contact) education													

¹ Education conducted with direct participation of university teachers or other academics

² Education with applied methods and techniques for distance learning



Distance learning														
TOTAL per year:														
Department of Biophysics and Neuroscience														
Direct (contact) education						33								
Distance learning	22													
Educational objectives														
C1. Description of physical phenomena responsible for processes occurring at the level of biomolecules, membranes, cells and tissues.														
C2. Description of physical bases of functioning of senses, circulation, electrical excitability related to signal transduction in the nervous system, neuromuscular transmission and electrical activity of the heart.														
C3. Acquisition of basic knowledge in medical physics in relation to therapeutic and diagnostic methods, in which ultrasounds, different forms of electromagnetic waves and radiation are used (e.g. USG, computed tomography, PET, NMR tomography, application of lasers in medicine).														
C4. Description of the effects of various physical factors on human organism in the context of therapy choice and protection of patients and medical personnel against hazardous impact of these														
C5. Development social competences needed to practice the medical profession, in accordance with graduate's profile														
Education result for course in relation to verification methods of the intended education result and the type of class:														
Number of detailed education result	Student who completes the course knows/is able to					Methods of verification of intended education results			Form of didactic class <i>*enter the abbreviation</i>					
B.W5	knows the physical laws describing fluid flow and factors affecting vascular resistance to blood flow;					Oral interrogation, written exam (single choice test)			L, LC					
B.W6.	knows the natural and artificial sources of ionising radiation and their interaction with matter;					Oral interrogation, written exam (single choice test)			L, LC					
B.W7	knows the physicochemical and molecular basis of the functioning of the sensory organs;					Oral interrogation, written exam (single choice test)			L, LC					
B.W8.	knows the physical basis of non-invasive imaging methods;					Oral interrogation, written exam (single choice test)			L, LC					
B.W9.	knows the physical basis of selected therapeutic techniques, including ultrasound and irradiation;					Oral interrogation, written exam (single choice test)			L, LC					
B.W20.	knows the basics of stimulation and conduction in the nervous system and higher nervous functions, as well as striated and smooth muscle physiology and					Oral interrogation, written exam			L, LC					



	blood functions;	(single choice test)	
B.U1	can use knowledge of the laws of physics to explain the effects of external factors such as temperature, acceleration, pressure, electromagnetic field and ionising radiation on the body and its components;	Oral interrogation, written exam (single choice test)	LC
B.U2.	can assess the harmfulness of the dose of ionising radiation and comply with radiological protection rules;	Oral interrogation, written exam (single choice test)	LC
B.U9.	can operate simple measuring instruments and assess the accuracy of the taken measurements;	Oral interrogation	LC
B.U13.	can plan and carry out simple scientific research, interpret the results and draw conclusions from them.	Oral interrogation	LC

* L- lecture; SE- seminar; AC- auditorium classes; MC- major classes (non-clinical); CC- clinical classes; LC- laboratory classes; CSC- classes in simulated conditions; PCP- practical classes with patient; FLC- foreign language course; PE- physical education; VP- vocational practice; DSS- directed self-study; EL- E-learning

Student's amount of work (balance of ECTS points):

Student's workload (class participation, activity, preparation, etc.)	Student Workload
1. Number of hours of direct contact:	33
2. Number of hours of distance learning:	22
3. Number of hours of student's own work:	67
4. Number of hours of directed self-study	n/a
Total student's workload	122
ECTS points for course	4,5

Content of classes:

Lectures (11 weeks/2 hours per week; online via Teams)

1. Ultrasounds in diagnosis and therapy
2. Biophysics of senses – acoustics and hearing
3. Electromagnetic radiation and its interaction with matter. Lasers in medicine.
4. Biophysics of senses - light and vision
5. Ionizing radiation - properties, effect on matter.
6. Ionizing radiation - application in medicine.
7. Physical bases of nuclear magnetic resonance (NMR) and its application in spectroscopy and imaging.
8. Physical basis of signal transmission in nervous system – nerve impulse, synaptic transmission. Ion channels – types and roles.
9. Biophysics of circulation.
10. Intermolecular interactions. Passive and active transport. Structures and models of biological membranes.
11. Application of thermodynamics to description of processes in biological systems.



Classes (11 weeks/3 hours per week; direct contact)

1. Emission spectra of elements.
2. Nephelometric determination of colloid concentration.
3. Examination of optical rotation of solutions and determination of concentration using a saccharimeter.
4. Fluorescence analysis.
5. Determination of focal length and radius of curvature of the eye model and focal length of correcting lens.
6. Estimation of flicker fusion threshold of photoreceptor cells of a human eye.
7. Ionic migration velocity.
8. Computer simulation of action potential generation.
9. Membrane potential measurement at Nernst equilibrium.
10. Microcalorimetric simulation studies on phase transitions in lipids.
11. Analog model of synaptic transmission.
12. Propagation of action potential along unmyelinated and myelinated axons.
13. Determination of the dead time of Geiger-Müller counter by the two-source method.
14. Interaction of β radiation with matter.
15. Estimation of the difference in visual latency in the Pulfrich effect.
16. Dipole model of a heart.
17. Audiometry.
18. Magnetic moment in the magnetic field.
19. Measurement of liquid flow velocity with the use of Doppler effect.
20. Study of properties of electromagnetic waves.
21. Harmonic analysis of acoustic waves.
22. Ultrasound probe.
23. Estimation of volume and radius of a single molecule applying the viscometric method.
24. Wave absorption in solutions of organic dyes. Analysis of solution composition.

Basic literature

1. Splinter R., Handbook of physics in medicine and biology. CRC Press 2010
2. Tuszyński & Kurzyński, Introduction to Molecular Biophysics, CRC Press 2003
3. Kane SA, Gelman BA, Introduction to Physics in Modern Medicine 3rd Edition, CRC Press 2020

Additional literature and other materials

4. Purves D, Neuroscience, Sinauer Associates, 2017
5. Bushberg JT, The essential physics of medical imaging, Wolters Kluwer, 2020
6. Cotterill R, Biophysics. An introduction, Wiley & Sons, 2004

Preliminary conditions:

Students are expected to possess basic knowledge in physics, biology and chemistry

Rules for granting partial grades in the subject during the semester:

Credit for practical exercises at students' laboratories is granted following verification of theoretical knowledge for each theme (oral interrogation or short written test during each class) and verification of written report for the experimental part. Credit for each subject has to be obtained.

Each absence must be made up, including rector's days or dean's hours. The form of making missed classes up should be agreed with the academic tutor (recommended: student's presentation prepared during self-study).



Conditions to receive credit for the course:

Gaining credit for practical exercises.

Written exam consisting of 40 questions (single-choice test). Positive grade is obtained when student receives score not smaller than 55% points. Grades higher than sufficient are obtained in proportion to the score. Analogous system is applied for retake exams. In the case of retake exams the lecturer may propose the oral form of examination.

Grade:	Criteria for courses ending with a grade
Very Good (5.0)	Score > 91%
Good Above (4.5)	91% > Score > 82%
Good (4.0)	82% > Score > 73%
Satisfactory Plus (3.5)	73% > Score > 64%
Satisfactory (3.0)	64% > Score > 55%
	Criteria for courses ending with a credit (without a grade)
Credit	
Grade:	Criteria for exam
Very Good (5.0)	Score > 91%
Good Above (4.5)	91% > Score > 82%
Good (4.0)	82% > Score > 73%
Satisfactory Plus (3.5)	73% > Score > 64%
Satisfactory (3.0)	64% > Score > 55%

Department in charge of the course	Department of Biophysics and Neurobiology
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CONSULTATION: Detailed information pertaining to the dates and places for consultation of academic staff are provided on the university websites of the departments in which the given subjects are being conducted. Additionally the information is posted next to the department secretary.



Date of Syllabus development

29.06.2022
