UNIWERSYTET MEDYCZNY
IM. PIASTÓW ŚLĄSKICH WE WROCŁAWIU

Appendix No.3
to Resolution No. 2303
of Senate of Wroclaw Medical University
of 28 April 2021

Syllabus for academic year: 2021/2022
Training cycle: 2021-2027

Description of the course

Course	Biophysics	Group of detailed education results: Group code B	Group name Basic medical sciences
Faculty	Faculty of Medicine		
Major	medicine		
Level of studies	X uniform magister studies ☐ 1st degree studies ☐ 2nd degree studies ☐ 3rd degree studies ☐ postgraduate studies		
Form of studies	X full-time ☐ part-time		
Year of studies	I	Semester:	X winter ☐ summer
Type of course	X obligatory ☐ limited choice ☐ free choice / optional		
Language of study	☐ Polish X 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 (Dep. in charge of the course)													
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	22												
TOTAL per year:													
Department of Biophysics and Neuroscience (Dep. in charge of the course)													
Direct (contact) education						33							
Distance learning	22												

Educational objectives (max. 6 items)

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 **enter the abbreviation*
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	L, LC

	B.W10. the structure of simple organic compounds that make up the macromolecules present in cells, the extracellular matrix and body fluids;	(single choice test)	
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 blood functions;	Oral interrogation, written exam (single choice test)	L, LC
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:	65,45
4. Number of hours of directed self-study	n/a
Total student's workload	120,45
ECTS points for course	5

Content of classes: (please enter topic words of specific classes divided into their didactic form and remember how it is translated to intended educational effects)

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)
Detailed schedule can be found on the webpage of Department of Biophysics and Neuroscience.

1. Ultrasonic Doppler effect
2. Audiometry
3. Harmonic analysis of acoustic waves
4. Determination of macromolecule's molecular weight by colloid solution viscosity measurements
5. Determination of electromagnetic waves properties
6. Ultrasound probe
7. Microcalorimetric method of investigation of phase transitions in lipids
8. Simulation of action potential generation
9. Propagation of action potential along unmyelinated and myelinated axons
10. Ionic migration velocity
11. Geiger-Muller counter characteristics
12. Nernst equilibrium (voltage measurements on ionoselective membranes)
13. Dipolar model of the heart
14. Ionizing radiation attenuation
15. Analog model of synaptic transmission
16. Determination of visual latency in the Pulfrich effect
17. Ionic migration velocity
18. Emission spectra
19. Nephelometric measurement of colloid concentration
20. Polarization of light, saccharimeter
21. Fluorescence and its application in quantitative luminescence analysis
22. Model of eye and description of optic prism properties
23. Absorption of solutions of organics dyes. Analysis of solution composition.
24. Examination of time resolution of the human eye

Basic literature (list according to importance, no more than 3 items)

1. 1. Splinter R., Handbook of physics in medicine and biology. CRC Press 2010
2. Tuszynski & Kurzynski, Introduction to Molecular Biophysics, CRC Press 2003
3. Kane SA, Introduction to physics in modern medicine, CRC Press 2009

Additional literature and other materials (no more than 3 items)

1. 1. Purves D, Neuroscience, Sinauer Associates, 2004,
2. Bushberg JT, The essential physics of medical imaging, Wolters Kluwer, 2012
3. Cotterill R, Biophysics. An introduction, Wiley & Sons, 2004

Preliminary conditions: (minimum requirements to be met by the student before starting the course)
Students are expected to possess basic knowledge in physics, biology and chemistry

Conditions to receive credit for the course: (specify the form and conditions of receiving credit for classes included in the course, admission terms to final theoretical or practical examination, its form and requirements to be met by the student to pass it and criteria for specific grades)
Attention! Attendance can not be a condition for passing the course

Credit for practical exercises at students' laboratories is granted following verification of theoretical knowledge for each theme (oral interrogation or short written test) and verification of written report for the experimental part. In the case of theoretical exercises, credit requires successful written test.
Written exam consists of approximately 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.
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).

Grade:	Criteria for courses ending with a grade[3]
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[3]
Credit	does not apply

Grade:	Criteria for exam[3]
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
Department address:	ul. Chałubińskiego 3a
Telephone:	71 784 15 51
E-Mail:	biofizyka@umed.wroc.pl

Person in charge for the course:	dr hab. Olga Wesołowska
Telephone:	71 784 14 15
E-Mail:	olga.wesolowska@umed.wroc.pl

List of persons conducting specific classes:

Name and surname	Degree/scientific or professional title	Discipline	Performed profession	Form of classes
Olga Wesołowska	DSc	Medical Sciences	academic teacher	lectures, practical classes

[3] The verification must cover all education results, which are realize in all form of classes within the course

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Andrzej Teisseyre	DSc	Physical Sciences	academic teacher	Practical classes
Kamila Środa-Pomianek	DSc	Medical Sciences	academic teacher	Practical classes
Marcin Kołaczkowski	DSc	Medical Sciences	academic teacher	Practical classes
Anna Palko-Łabuz	PhD	Medical Sciences	academic teacher	Practical classes
Grzegorz Wiera	PhD	Medical Sciences	academic teacher	Practical classes

Date of Syllabus development

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Uniwersytet Medyczny we Wrocławiu
KATEDRA I ZAKŁAD BIOFIZYKI
I NEUROBIOLOGII
adiunkt
dr hab. Olga Wesołowska

Syllabus developed by
dr hab. Olga Wesołowska

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Signature of Head(s) of teaching unit(s)

Uniwersytet Medyczny we Wrocławiu
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I NEUROBIOLOGII
kierownik
prof. dr hab. Jerzy Mozrzymas

Dean's signature

Wrocław Medical University
Faculty of Medicine
Vice-Dean for Clinical Studies
prof. Beata Sobieszczańska, PhD