	Tr	aini	Syllab	us for	acade	mic ye 2021	ear: 20 - 2	020/20 025	21 a.c	26				
			3 -10			n of the			A	10				
Module/Course						nysics			resi	Group of detailed education results Group Group name				
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Faculty		N	/ledicir	ne		====			_					
Major		r	nedicir	ne										
Unit realizing the subj	ect)eparti	ment c	of Biop	hysics	and Ne	euroscie	ence					
Specialties		r	ot app	licable	2									
Level of studies		Ţ	Jniforr	n magi	ster st	udies >	(*							
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		2	2 nd deg	ree stu	udies 🗆]								
		3	3 rd deg	ree stu	ıdies \square									
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Form of studies)	(full-t	ime	□ par	t-time								
Year of studies		1						Semes	ster	X Winter Summer				
Type of course)	(oblig	atory										
		1	∃limite	ed cho	ice									
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Course] [□ majo	r X bas	sic									
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* mark 🗆 with an X		=/												
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					Form	of edu	cation							
	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)	Specialist Classes – magister studies (SCM)	Foreign language Course (FLC)	Physical Education obligatory (PE)	Vocational Practice (VP)	Self-Study (Student's own work)	E-learning (EL)
Winter Semester	1		L -		_									
Direct (contact) education						18								
Online learning (synchronous)	22					15								

Distance learning									
(asynchronous)									
Summer Semester									
Direct (contact)									
education									
Online learning									
(synchronous)						- 1		. 1	
Online learning									
(asynchronous)									
TOTAL per year:									
Direct (contact)			18						
education									
Online learning	22		15						
(synchronous)									
Online learning									
(asynchronous)									

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 factors.

Education result matrix for module/course in relation to verification methods of the intended education result and the type of class

Number of course education result	Number of major education result	Student who completes the module/course knows/is able to	Methods of verification of intended education results (forming and summarising)	Form of didactic class **enter the abbreviation
W01	B.W5	Knows physical laws describing fluid flows and factors determining haemodynamic resistance of blood capillaries Knows natural sources of ionizing radiation and its interaction with	Oral interrogation, written exam Oral interrogation, written exam	L, LC
W03	B.W7	matter Knows physico-chemical bases of senses	Oral interrogation, written exam	L, LC

W04	B.W8	Knows physical bases of non-invasive imaging methods Knows physical bases of selected	Oral interrogation, written exam Oral interrogation, written	L, LC
W05	B.W9	therapeutic techniques including ultrasounds and irradiation	exam	L, LC
w06	B.W20	Knows base of excitability and conduction in the nervous system and higher functions of the nervous system and the physiology of striated and smooth muscles and functions of blood	Oral interrogation, written exam	L, LC
W07	B.W29	Knows the rules of carrying out the scientific research based on observations and experiments and in vitro studies aimed at development of medicine.	Oral interrogation, written exam	L,
U01	B.U1	Applies the laws of physics to explain the effects of external factors such as temperature, acceleration, pressure, electromagnetic field and radiation on the organism and its elements	Oral interrogation, written exam	LC
U02	B.U2	Is able to assess the extent of hazard for ionizing radiation and applies the rules of radiological protection	Oral interrogation, written exam	LC
U03	B.U9	Applies simple measuring devices and assesses the precision of measurements	Work during classes, oral interrogation	LC
U04	B.U13	Plans and executes simple scientific investigations as well as interprets obtained data and draws conclusions	Work during classes, oral interrogation	LC
K 01		Co-operates in the group while performing experiments (laboratory classes); activerly performs experimental measurements; takes responsibility for the laboratory equipment		

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

Please mark on scale 1-5 how the above effects place your classes in the following categories: communication of knowledge, skills or forming attitudes:

Knowledge:5

Skills:5

Social competences:5

Student's amount of work (balance of ECTS points)	
Student's workload	Student Workload (h)
(class participation, activity, preparation, etc.)	
1. Contact hours:	18
2. Online learning hours (e-learning):	37
3. Student's own work (self-study):	82,5
Total student's workload	137,5
ECTS points for module/course	6,5
Comments	

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

- 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, physical bases of electrocardiography
- 10. Intermolecular interactions. Passive and active transport. Structures and models of biological membranes.
- 11. Application of thermodynamics to description of processes in biological systems.

Seminars

- 1.
- 2.
- 3.

Practical classes

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

On-line classes:

- 1. Emission spectra of elements.
- 2. Examination of optical rotation of solutions and determination of concentration using a saccharimeter.
- 3. Fluorescence and its application in quantitative luminescence analysis.
- 4. Ionic migration velocity.
- 5. Magnetic moment in the magnetic field.
- 6. Estimation of volume and radius of a single molecule with the viscometric method
- 7. Detection of ionizing radiation with Geiger-Mueller counter.
- 8. Attenuation of ionizing radiation.
- 9. Microcalorimetric simulation studies on phase transitions in lipids.
- 10. Study of properties of electromagnetic waves.
- 11. Radiation absorption in solutions of organic dyes. Analysis of solution composition.
- 12. Determiantion of size of molecules forming a monomolecular layer

On-site classes:

- 1. Nephelometric determination of colloid concentration.
- 2. Model of eye and description of optic prism.
- 3. Examination of time resolution of the human eye.
- 4. Nernst equilibrium (voltage measurements on ionoselective membranes).
- 5. Dipole model of the heart.
- 6. Analog model of synaptic transmission.
- 7. Simulation of action potential generation.
- 8. Audiometry.
- 9. Propagation of action potential along myelinated and unmyelinated axons.
- 10. Measurement of liquid flow velocity with the use of Doppler effect.
- 11. Harmonic analysis of acoustic waves.
- 12. Ultrasound probe.

Other

1.

2.

3.

etc. ...

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

- 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. 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

Didactic resources requirements (e.g. laboratory, multimedia projector, other...)

Laboratories are equipped with experimental set ups for each students' group, multimedia projector, computers.

Preliminary conditions (minimum requirements to be met by the student before starting the module/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 module/course, admission terms to final theoretical or practical examination, its form and requirements to be med by the student to pass it and criteria for specific grades)

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 30-50 questions (single-choice test). Positive grade is obtained when student receives score not smaller than 60% points. Grades higher than sufficient are obtained in proportion to the score and the intervals for subsequent (higher) grades are equal. 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 (only for courses/modules ending with an examination)
Very Good	Score > 92%
(5.0)	
Good Plus	92% > Score > 84 %
(4.5)	
Good	84 > Score > 76 %
(4.0)	
Satisfactory Plus	76% > Score > 68 %
(3.5)	
Satisfactory	68 %> Score > 60%
(3.0)	
Type Stange III	Criteria (only for courses/modules ending with e credit)
Credit	Does not apply to the Faculty of Medicine

Grade:	Criteria (examination evaluation criteria)	
Very Good	Score > 92%	
(5.0)		
Good Plus	92% > Score > 84 %	
(4.5)		
Good	84 > Score > 76 %	
(4.0)		
Satisfactory Plus	76% > Score > 68 %	
(3.5)		



Satisfactory	68 %> Score > 60%
(3.0)	
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subject	
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Full name	Degree/scientific or professional title	Discipline	Performed profession	Form of classes
Olga Wesołowska	DSc	Medical Sciences	Adjunct	lectures, practical classes
Andrzej Teisseyre	DSc	Medical Sciences	Adjunct	Practical classes
Kamila Środa- Pomianek	DSc	Medical Sciences	Adjunct	Practical classes
Marcin Kołaczkowski	DSc	Medical Sciences	Adjunct	Practical classes
Anna Palko-Łabuz	PhD	Medical Sciences	Adjunct	Practical classes
Grzegorz Wiera	PhD	Medical Sciences	Adjunct	Practical classes

Date of Syllabus development

28.09.2020.

Syllabus developed by

dr hab. Olga Wesołowska

prof. dr hab. Jerzy Mozrzymas

Signature of Head of teaching unit

Signature of Faculty Dean

prof. Beata Seszczańska, PhD