



TOTAL per year: 45												
	10				35							
<p>Educational objectives (max. 6 items)</p> <p>C1. Understanding physical bases of processes that occur in biological systems on the level of biomolecules, biological membranes, cells, tissues, organs and the whole human organism.</p> <p>C2. Knowing physical bases of modern medical diagnostic and therapeutic methods, and some experimental methods applied in studying biological systems.</p> <p>C3. Studying physical bases of radiology and properties of a laser light and application of lasers in dentistry.</p> <p>C4. Getting knowledge about an influence of various physical factors on a human organism.</p> <p>C5. Studying bases of biomechanics.</p> <p>C6. Getting ability to use various laboratory equipment, perform measurements applying spectroscopic, electrical, optical and other methods, getting ability to use professional computer software and to analyze obtained experimental data.</p>												
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 <i>**enter the abbreviation</i>								
W 01	BW7 , BW8	1.Knowledge of principles of statics and biomechanics in relation to a human organism and mechanics of the organ of mastication.	Oral answers and colloquia during laboratory practicals, written examination test	L								
	BW9	2.Knowledge of physical bases of methods of imaging of tissues and organs and principles of function of diagnostic equipment used for these purposes.	Mentioned above	L, LC								
	BW10	3.Knowledge of principles of function of ultrasonic devices and their application in diagnostics and therapy .	Mentioned above	L, LC								
	BW11	4.Knowledge of principles of photometry and principles of function of optical fibers and application of light sources in dentistry .	Mentioned above	L, LC								



	BW12, BW13	5.Knowledge of principles of work of lasers and their application in dentistry .	Mentioned above	L, LC
	BW19	6.Knowledge of selected life functions of a human organism – physical bases of function of nerve system and function of selected sensory organs .	Mentioned above	L, LC
U 01	BU2	1.Ability of interpretation of physical phenomena in a human organism, in particular, in the organ of mastication .	Oral answers and colloquia during laboratory practicals, written examination test	L, LC
	BU3	2.Ability of application of proper methods of imaging diagnostics in a work of a dentist.	Mentioned above	L, LC
	BU3	3.Ability of application of ultrasounds in a work of a dentist.	Mentioned above	L, LC
	BU3	4.Ability of application of properly-selected laser light in a clinical practice.	Mentioned above	L, LC
	BU3	5.Ability of application of ionising radiation and ability of estimation of an irradiation risk.	Mentioned above	L, LC
K 01		Student actively participates in a team work; is creative; thinks logically and independently; learns how to face challenges; is interested in a self-education.	Credit note for completed laboratory practicals Mentioned above Mentioned above	LC LC LC LC

** 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: +++++

Skills: +++++



Social competences: +++++	
Student's amount of work (balance of ECTS points)	
Student's workload (class participation, activity, preparation, etc.)	Student Workload (h)
1. Contact hours:	45
2. Student's own work (self-study):	45
Total student's workload	90
ECTS points for module/course	5
Comments	
<p>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)</p> <p>Physical aspects of a transportation of substances across biological membranes and signal transduction. Physical bases of electrophysiology – nerve impulse, neuromuscular transmission, muscle contraction. Biophysics of systems and sensory organs. Selected topics of medical physics; lasers in medicine – generation of a laser light, types of lasers, optical fibers, application in dentistry. Phenomenon of the nuclear magnetic resonance (NMR) and its application in a medical diagnostics and biomedical studies. Influence of physical factors on a human organism. Principles of biomechanics.</p>	
<p>Lectures</p> <ol style="list-style-type: none"> 1. Physical aspects of a transportation of substances across biological membranes and signal transduction. Physical bases of electrophysiology. 2. Biophysics of systems and sensory organs. 3. Sound, ultrasound, principles of work of ultrasonic devices, application of ultrasound in medical diagnostics and therapy. 4. Light – sources of light, photometry, types of electromagnetic radiation, properties of a laser light. 5. Types of lasers and their application in medicine. 6. Imaging of tissues and organs applying ionizing radiation (CT, PET, scintigraphy). 7. Physical bases of the nuclear magnetic resonance (NMR). 8. Magnetic Resonance Imaging (MRI). 9. Influence of physical factors on a human organism, selected therapeutic methods. 10. Principles of biomechanics in relation to human organism. 	
<p>Seminars</p> <p>None</p>	
<p>Practical classes:</p> <p><u>1. Laboratory of Bioacoustics and Mechanics:</u></p> <ol style="list-style-type: none"> 1. Ultrasonic Doppler effect 2. Measurements of the activation threshold of human ear 3. Sound spectral analysis 	



4. Estimation of macromolecule's molecular weight by colloid solution viscosity measurements
5. Studies on properties of electromagnetic waves
6. Ultrasonic probe
7. Simulation of measurements of phase transitions in selected lipids applying a microcalorimetric method

2. Laboratory of Bioelectricity:

1. Computer simulation of action potential generation in an axon
2. Estimation of a membrane potential on an ion-selective membrane under equilibrium conditions
3. Dipolar model of an electrical activity of a heart
4. Detection of ionizing radiation applying a Geiger-Müller counter
5. Estimation of ionizing radiation's attenuation coefficient
6. Analog model of the synaptic transmission
7. Transportation of ions across biological membranes
8. Magnetic moment in a magnetic field

3. Laboratory of Biooptics and Spectroscopy:

1. Study on a time resolution of a human eye
2. Estimation of a colloid solution concentration applying a nephelometric method
2. Study on the optical activity of solutions and estimation of their concentrations using a polarimeter
4. Fluorescence of organic dyes and its application in the quantitative luminescence analysis
5. Eye model and estimation of parameters of a prism
6. Absorption of solutions of organic dyes. Analysis of contents of solutions.

Other

None

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

1. Cotterill R. ***Biophysics. An introduction.*** J. Wiley & Sons, 2004.
2. Davidovits P. ***Physics in biology and medicine.*** 4-th ed. – Amsterdam: Elsevier Academic Press, 2013.
3. Bushberg J.T. [et al.] ***The essential physics of medical imaging.*** 3-rd ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2012.

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

1. Glaser R. ***Biophysics.*** Springer-Verlag, 2004.



2. Glaser R. *Biophysics an introduction*. 2-nd ed. – Berlin: Springer, 2012.
3. Hille B. *Ionic Channels of Excitable Membranes*. Sinauer Associates inc. Sunderland, 2004.

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

Equipment setups for laboratory practicals in laboratories, multimedia projectors, computers, standard and specialist software.

Preliminary conditions (minimum requirements to be met by the student before starting the module/course)

A student should have complete knowledge in the area of physics at the high school level

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 met by the student to pass it and criteria for specific grades)

Final examination test - condition of admittance is a previous getting a final credit note from the laboratory classes.

Grade:	Criteria (only for courses/modules ending with an examination)
Very Good (5.0)	56-60
Good Plus (4.5)	51-55
Good (4.0)	46-50
Satisfactory Plus (3.5)	41-45
Satisfactory (3.0)	36-40

Name and address of module/course teaching unit, contact: telephone and e-mail address

Wrocław Medical University

Department of Biophysics,

Ul. Chałubińskiego 10

50-368 Wrocław, Poland

Head of Department: Prof. dr hab. Krystyna Michalak,

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Coordinator / Person responsible for module/course, contact: telephone and e-mail address



dr hab. inż. Andrzej Teisseyre , tel: 71-784-14-14, mobile: 696-294-255

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List of persons conducting specific classes: full name, degree/scientific or professional title, discipline, performed profession, form of classes.

Dr hab. inż. Andrzej Teisseyre – associate professor in biomedical sciences, speciality – biophysics, Ph. D. in biomedical sciences, M. Sci. in chemistry, university lecturer (adiunkt) – lectures and laboratory classes.

Dr Kamila Środa-Pomianek - Ph. D. in biomedical sciences, M. Sci. in biotechnology, university lecturer (adiunkt) – laboratory classes.

Dr Anna Palko-Labuz - Ph. D. in biomedical sciences, M. Sci. in biotechnology, university assistant (asystent) – laboratory classes.

Date of Syllabus development

Syllabus developed by

.....03-07-2017.....

. dr hab. Andrzej Teisseyre

Signature of Head of teaching unit

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Signature of Faculty Dean

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