

## DESCRIPTION OF THE COURSE OF STUDY

<b>Course code</b>	<b>0912-7LEK-B2.1-Bf</b>	
<b>Name of the course in</b>	Polish	<b>Biofizyka</b>
	English	<b>Biophysics</b>

### 1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

<b>1.1. Field of study</b>	Medicine
<b>1.2. Mode of study</b>	Full-time
<b>1.3. Level of study</b>	Uniform Master's studies
<b>1.4. Profile of study*</b>	General academic
<b>1.5. Specialization*</b>	lack
<b>1.6. Unit running the course of study</b>	Faculty of Mathematics and Natural Sciences Institute of Physics, The Department of Molecular Physics
<b>1.7. Person/s preparing the course description</b>	dr hab. Tadeusz Kosztolowicz, prof. UJK
<b>1.8. Person responsible for the course of study</b>	dr hab. Tadeusz Kosztolowicz, prof. UJK
<b>1.9. Contact</b>	tadeusz.kosztolowicz@ujk.edu.pl

### 2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

<b>2.1. Affiliation with the module</b>	Scientific basis of medicine
<b>2.2. Language of instruction</b>	English
<b>2.3. Semesters in which the course of study is offered</b>	4 <sup>th</sup> semester
<b>2.4. Prerequisites*</b>	The basics of Physics, Chemistry and Biology in the scope of the secondary school

### 3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

<b>3.1. Form of classes</b>	Lecture- 20, classes- 15, laboratories-15	
<b>3.2. Place of classes</b>	Courses in the teaching rooms of the UJK. The Faculty of Mathematics and Natural Sciences	
<b>3.3. Form of assessment</b>	Credit/ exam, laboratory/ classes – credit with grade	
<b>3.4. Teaching methods</b>	Lecture: informative, problematic, demonstration, film, laboratory, measurement	
<b>3.5. Bibliography</b>	<b>Required reading</b>	1. Cotterill Rodney , Biophysics an Introduction, 978-0-471-48538-4, John Wiley & Sons,2002
	<b>Further reading</b>	2. Glaser Roland, Biophysics, 978-3-540-67088-9, Springer Verlag,

### 4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED TEACHING OUTCOMES

#### 4.1. Course objectives (for all forms)

- C1 - understanding the physical basis of the mechanisms that governs physiological processes in living organisms: L, C, La  
 C2 – familiarizing with the physical basis of the functioning of organs and organ systems of the human body: L, C  
 C3 – acquiring the knowledge of physical methods in medical research: L, C, La  
 C4 - understanding the mechanisms and effects of physical as well as biophysical environmental factors on the human body: L, C  
 C5 – planning and carrying out the measurements as well as analyzing the results: La

#### 4.2. Detailed syllabus (including form of classes)

Lecture: C1, C2, C3, C4

Biothermodynamics: energetics of active and passive transport through membranes, mechanisms of substance transport. Self-organization of molecules in biological systems. The Models of biological membranes.

Surface phenomena. The strength of adhesion and cohesion.

Biomechanics. Systems: cardiovascular, respiratory.

Action stimuli: temperature, pressure on the human body.

Acoustic waves and their impact on the organism. Biophysical basics of the functioning of the sense of hearing.

Ultrasounds- formation and application in medicine (ultrasound imaging technique).

Bioelectricity: propagation of electrical impulses in nerve and muscle cells.

Electrical conductivity of matter. Impedance of cells and tissues.

Electric and magnetic fields. Electric and magnetic properties of matter.

The influence of fields: the electric and magnetic fields on the organism.

The phenomenon of view, defects of optical mapping, defects of vision.

Radiation Biophysics: the influence of ionizing radiation and non-ionizing radiation with matter and the influence on the biological tissue.

The spectrum of electromagnetic waves (visible spectrum, X-ray spectrum).

Detection methods of nuclear radiation.

The methods of physical tests (optical tomography, NMR imaging, optical microscopy and AFM).

Classes: C1, C2, C3, C4

Biothermodynamics: energetics of active and passive transport through membranes, mechanisms of substance transport. Surface phenomena. Biomechanics. Systems: cardiovascular, respiratory.

Action stimuli: temperature, pressure on the human body. Acoustic waves and their impact on the organism. Ultrasounds- formation and application in medicine (ultrasound imaging technique).

Bioelectricity: propagation of electrical impulses in nerve and muscle cells. Electric and magnetic fields.

Electric and magnetic properties of matter. The influence of fields: the electric and magnetic fields on the organism. The phenomenon of view, defects of optical mapping, defects of vision. The spectrum of electromagnetic waves (visible spectrum, X-ray spectrum).

Laboratory: C1, C3, C5

The students take part in 10-12 laboratories:

1. The determination of the surface tension of the liquid by means of weight torsion.
2. Experimental checking of an inviscid flow of Bernoulli's principle.
3. The study of dependence of the viscosity of the polymer on temperature. Determination of activation energy as well as the size of the particles.
4. The determination of factors: diffusion and filtration membranes.
5. The examination of the piezoelectric effect.
6. The examination of magnetic field by means of Hall probe.
7. The examination of the relationship of electrical conductivity; dependence of conductors and semiconductors on temperature.
8. The study of electrical potentials in membrane systems.
9. The study of the topography of tissue using atomic force microscopy.
10. Diffraction study of ultrasounds.
11. The examination of the polarization of light. The law of Malus.
12. The measurement of radon activity.

#### 4.3. Education outcomes in the discipline

Code	A student, who passed the course	Relation to teaching outcomes
within the scope of <b>KNOWLEDGE:</b>		
W 1	knows the physical laws describing the flow of fluids and factors affecting the vascular resistance of blood flow	B. W5
W 2	knows natural and artificial sources of ionizing radiation and its interaction with the matter;	B W 6
W 3	knows the physical, chemical and molecular basis of how the organs of the senses function;	B W 7
W 4	knows the physical basis of non-invasive imaging methods;	B W 8
W 5	knows the physical principles of selected therapeutic techniques, including ultrasound and radiation;	B W 9
W 6	knows the possibilities of modern telemedicine as a tool to support the work of a physician;	B W 33
within the scope of <b>ABILITIES:</b>		
U 1	uses the knowledge of the laws of physics to explain the impact of external factors such as temperature, acceleration	B. U 1
U 2	assesses harmful ionizing radiation dose and applies the principles of radiation protection;	B. U 2
U 3	operates simple measuring instruments and evaluates the accuracy of measurements;	B. U 10
U 4	uses databases, including online ones, and searches for necessary information using available tools;	B. U 11
U 5	plans and performs basic scientific research, interprets the results and draws conclusions.	B. U 14

#### 4.4 Methods of assessment of the intended teaching outcomes

Teaching outcomes (code)	Method of assessment (+/-)																				
	Exam oral/written*			Test*			Project*			Effort in class*			Self-study*			Group work*			Report*		
	Form of classes			Form of classes			Form of classes			Form of classes			Form of classes			Form of classes					
	L	C	La	L	C	La	L	C	La	L	C	La	L	C	La	L	C	La	L	C	La
W1	+			+																	+
W2	+			+																	+
W3	+			+																	+
W4	+			+																	+
W5	+			+																	+
W6	+			+																	+
U1	+			+																	+
U2	+			+																	+
U3																					+
U4																					+
U5																					+

\*delete as appropriate

4.5. Criteria of assessment of the intended teaching outcomes		
Form of classes	Grade	Criterion of assessment
lecture (L)	3	Exam-test, 61-68% of correct answers
	3,5	Exam -test, 69-76% of correct answers
	4	Exam -test, 77-84% of correct answers
	4,5	Exam -test, 85-92% of correct answers
	5	Exam -test, 93-100% of correct answers
classes (C)*	3	61-68% Pass the test on satisfactory grade and credit reports of the classes
	3,5	69-76% Pass the test on more than satisfactory grade and credit reports of the classes
	4	77-84% Pass the test on good grade and credit reports of the classes
	4,5	85-92% Pass the test on more than good grade and credit reports of the classes on time
	5	93-100% Pass the test on very good grade and credit reports of the classes on time
laboratory classes(La)*	3	61-68% Pass the laboratory exercises reports on a satisfactory grade
	3,5	69-76% Pass the laboratory exercises reports on more than a satisfactory grade
	4	77-84% Pass the laboratory exercises reports on a good grade
	4,5	85-92% Pass the laboratory exercises reports on more than a good grade
	5	93-100% Pass the laboratory exercises reports on a very good grade

- Thresholds are valid from 2018/ 2019 academic year

#### 5. BALANCE OF ECTS CREDITS – STUDENT’S WORK INPUT

Category	Student's workload
	Full-time studies
<i>NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/</i>	<b>50</b>
<i>Participation in lectures*</i>	<b>20</b>
<i>Participation in classes, seminars, laboratories*</i>	<b>30</b>
<i>Preparation in the exam/ final test*</i>	
<i>Others*</i>	
<i>INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/</i>	<b>25</b>
<i>Preparation for the lecture*</i>	
<i>Preparation for the classes, seminars, laboratories*</i>	<b>20</b>
<i>Preparation for the exam/test*</i>	<b>5</b>
<i>Gathering materials for the project/Internet query*</i>	
<i>Preparation of multimedia presentation</i>	
<i>Others*</i>	
<i>TOTAL NUMBER OF HOURS</i>	<b>75</b>
ECTS credits for the course of study	<b>3</b>

*Accepted for execution* (date and signatures of the teachers running the course in the given academic year)

.....