

DESCRIPTION OF THE COURSE OF STUDY

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

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

1.1. Field of study	Medicine
1.2. Mode of study	Full-time
1.3. Level of study	Uniform Master's studies
1.4. Profile of study*	General academic
1.5. Person preparing the course description	dr hab. Tadeusz Kosztolowicz, prof. UJK
1.6. Contact	tadeusz.kosztolowicz@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Language of instruction	English
2.2. Prerequisites*	The basics of Physics, Chemistry and Biology in the scope of the secondary school

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes	Lecture- 20, classes- 15, laboratories-15	
3.2. Place of classes	Courses in the teaching rooms of the UJK. The Faculty of Mathematics and Natural Sciences	
3.3. Form of assessment	Credit/ exam, laboratory/ classes – credit with grade	
3.4. Teaching methods	Lecture: informative, problematic, demonstration, film, laboratory, measurement	
3.5. Bibliography	Required reading	Davidovits Paul, Physics in Biology and Medicine, 978-0-12-386513-7, Elsevier, 2013.
	Further reading	1. Cotterill Rodney, Biophysics an Introduction, 978-0-471-48538-4, John Wiley & Sons, 2002. 2. Glaser Roland, Biophysics, 81-8128-126-8, Springer Verlag, 2004.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES

<p>4.1. Course objectives (<i>including form of classes</i>)</p> <p>C1 - understanding the physical basis of the mechanisms that governs physiological processes in living organisms: L, C, La</p> <p>C2 – familiarizing with the physical basis of the functioning of organs and organ systems of the human body: L, C</p> <p>C3 – acquiring the knowledge of physical methods in medical research: L, C, La</p> <p>C4 - understanding the mechanisms and effects of physical as well as biophysical environmental factors on the human body: L, C</p> <p>C5 – planning and carrying out the measurements as well as analyzing the results: La</p>
<p>4.2. Detailed syllabus (<i>including form of classes</i>)</p> <p>Lecture: C1, C2, C3, C4</p> <p>Basic concepts in mechanics. Static forces. Equilibrium and stability. Stability of human body. Skeletal muscles. Levers, the elbow, the hip, the back. Translational and angular motion. Friction. Vertical jump. Energy consumed in physical activity. Forces on curved path. Pendulum. Energy in running. Elasticity of materials. Longitudinal stretch and compression. A spring. Bone fracture. Fracture due to fall. Fluids. Force and pressure in fluid. Pascal's principle. Archimedes' principle. Surface tension. Motion of fluids. Bernoulli's equation. Viscosity and Poiseuille's law. Turbulent flow. Circulation of the blood. Blood pressure. Power produced by the heart. Heat and kinetic theory. Kinetic theory of matter. Transfer of heat. Diffusion. Diffusion through membranes. The respiratory system. First and second laws of thermodynamics. Thermodynamics of living systems. Energy requirements of people. Energy from food. Regulation of body temperature. Convection, radiation, evaporation. Waves and sound. Properties of waves, reflection, refraction, interference, diffraction. Hearing and the ear. Doppler effect. Clinical uses of sound. Ultrasonic waves. Basic concepts in electricity and magnetism. The nervous system. Electrical technology in medical research. The electrocardiograph, the electroencephalograph. Physiological effects of electricity. Basic concepts in optics. Nature of light. Structure of the eye. Lens system of the eye. Accommodation. Defects in vision. Atomic and nuclear physics. The atom. Spectroscopy. X-rays. Radiation therapy. Nuclear magnetic resonance.</p>

Classes: C1, C2, C3, C4

Stability of human body. Levers, the elbow, the hip, the back. Energy consumed in physical activity. Pendulum. Energy in running. Bone fracture. Fracture due to fall. Force and pressure in fluid. Viscosity and Poiseuille's law. Circulation of the blood. Blood pressure. Power produced by the heart. Transfer of heat. Diffusion. Diffusion through membranes. The respiratory system. Thermodynamics of living systems. Energy requirements of people. Energy from food. Properties of waves, reflection, refraction, interference, diffraction. Doppler effect. Electricity and magnetism: the nervous system. Lens system of the eye. Accomodation. Defects in vision. The atom. Spectroscopy. Energy of photon.

Laboratory: C1, C3, C5

The students perform 4-6 exercises from the following list:

1. Determining surface tension of liquids with the application of torsion balance.
2. Study of inviscid flow. Testing Bernoulli's principle.
3. Study of the dependence of glycerine viscosity on temperature. Determination of activation energy.
4. Study of electrical potentials in membrane systems.
5. Study of the magnetic field using the Hall probe.
6. Study of the topography of tissue using atomic force microscopy.
7. Study of diffraction and absorption of ultrasonic waves.
8. Study of polarization of light. Testing the Malus' law.

4.3 Intended learning outcomes

Code	A student, who passed the course	Relation to learning outcomes
within the scope of KNOWLEDGE the graduate knows and understands:		
W 1	the physical laws describing the flow of fluids and factors affecting the vascular resistance of blood flow	B. W5.
W 2	natural and artificial sources of ionizing radiation and its interaction with the matter;	B. W6.
W 3	the physical, chemical and molecular basis of how the organs of the senses function;	B. W7.
W 4	the physical basis of non-invasive imaging methods;	B. W8.
W 5	the physical principles of selected therapeutic techniques, including ultrasound and radiation;	B. W9.
W 6	the possibilities of modern telemedicine as a tool to support the work of a physician;	B. W28.
within the scope of ABILITIES the graduate knows how to:		
U 1	use the knowledge of the laws of physics to explain the impact of external factors such as temperature, acceleration	B. U1
U 2	assesse harmful ionizing radiation dose and applies the principles of radiation protection;	B. U2
U 3	operate simple measuring instruments and evaluates the accuracy of measurements;	B. U9
U 4	use databases, including online ones, and searches for necessary information using available tools;	B. U10
U 5	plan and perform basic scientific research, interprets the results and draws conclusions.	B. U13

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

*delete as appropriate

4.5. Criteria of assessment of the intended learning 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
others (...)*	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

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

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

**delete as appropriate*

¹ e-learning (without participation of the lecturer)

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

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