INFORMATION ABOUT THE COURSE

Biophysics

1. Basic information

Field of studies field of medical and health sciences, discipline: medical sciences **Unit responsible for the field of studies** Faculty of Medicine Bydgoszcz University of Science and Technology **Level of studies** Uniform master's studies **Profile of studies** General academic **Form of studies** Full-time	**Studies cycle** …….. **Course code** 17-EMS-BPH-SP1 **Language** English **Obligatory** Yes

Prerequisites	None
Introductory courses	None
Coordinator	Jacek Siódmiak, PhD

Study period	**Form of assessment** **Form and hours of classes**	**ECTS credits**
Winter semester	Exam Lecture 15h Exercise 30h	3.0

2. Learning outcomes

Code	**Description of learning outcomes**	**Learning outcomes reference**
Knowledge (student knows and understands):		
K1	The graduate knows and understands the concepts of: solubility, osmotic pressure, isotonia, colloidal solutions and Gibbs-Donnan equilibrium	B.W3.
K2	The graduate knows and understands the physical laws describing the flow of liquids and factors influencing the vascular resistance of blood flow	B.W4.
K3	The graduate knows and understands the natural and artificial sources of ionizing radiation and its interaction with matter	B.W5.
K4	The graduate knows and understands the physicochemical and molecular basis of the functioning of sense organs	B.W6.
K5	The graduate knows and understands the physical basis of non-invasive imaging methods	B.W7.

K6	The graduate knows and understands the physical basis of selected therapeutic techniques	B.W8.
Abilities (student can do/perform):		
A1	The graduate is able to use knowledge of the laws of physics to explain the influence of external factors, such as temperature, acceleration, pressure, electromagnetic field and ionizing radiation, on the human body	B.U1.
A2	The graduate is able to assess the influence of ionizing radiation dose on normal and diseased tissues of the body and adhere to the principles of radiological protection	B.U2.
A3	The graduate is able to use basic laboratory and molecular techniques	B.U12.
Social skills (the student is ready to):		
S1	The graduate is ready to perceive and recognize their own limitations, perform self-assessment of deficits and educational needs	O.K5.
S2	The graduate is ready to formulate conclusions from their own measurements or observations	O.K8.
S3	The graduate is ready to implement the principles of professional camaraderie and cooperation in a team, including with representatives of other medical professions, also in a multicultural and multinational environment	O.K9.

3. Programme contents

No.	Programme contents	Form of studies	Learning outcomes covered by the programme content
1	**I Human Body Mechanics** • Mammalian Skeletal System: Skeleton as a System of Simple Machines, Levers in Biomechanics • Center of Mass of a System of Points • Biophysics of Muscle Tissue: Mechanical Properties of Muscle, Muscle Energetics, Biomechanical Properties of Muscles Importance of Biophysical Properties of Tissues in BiomechanicsFundamental Issues and Laws Related to Deformations • Hierarchical Structure of Bone Tissue and Its Influence on Bone Mechanical Properties • Biomechanical Properties of Bone Tissue • Piezoelectric Effect in the Process of Strengthening Bone Tissue **II Hemodynamics** • Basics of the Biophysics of the Circulatory and Respiratory Systems • Laws of Hydrodynamics: Law of Stream Continuity, Bernoulli's Law	Lecture	K1, K2, K3, K4, K5, K6

	• Vascular Resistance to Flow, Physical Factors Affecting Vascular Resistance • Dynamic and Static Pressure in the Circulatory System • The Role of Diffusion in the Exchange of Respiratory Gases • Hyren's Law, Solubility of Gases • Hagen-Poisson's Law **III Cells Electrophysiology** • Cell electrophysiology: resting and action potential, electrotonic • Sense organs – biophysical processes occurring in sense organs **IV Physical factors** • Impact of physical factors on living organisms • Impact of mechanical factors on living organisms • Physical foundations of rehabilitation procedures: electrotherapy, magnetotherapy, light therapy, ultrasound • Importance of selected physical factors in diagnostics and therapyElastic waves in diagnostics: generation and detection of ultrasonic waves, resolving power • Fundamentals of NMR tomography: magnetism, nuclear magnetism, spin and magnetic moment of the nucleus, role of contrast agents		
2	• Statistical methods of developing measurement results. • Physical and physicochemical quantities and methods of their measurement. • Basic measuring instruments for physical quantities. • Length/thickness measurements, electrical and magnetic measurements, microscopes, time measurements, energy and work measurements, viscosity and density measurements, flows, measurements of mechanical properties of various materials including bones, optical properties of materials, properties of sound and light waves.	Exercise	K1, K2, K3, K4, K5, K6, A1, A2, A3, S1, S2, S3

4. Methods of verifying and assessing the learning outcomes achieved by the student

Winter semester

Form of studies		
Lecture	**Methods of studies form:**	
	Lecture	
	Methods of verification:	**Involvement:**
	Written exam	100%
	Conditions for passing the course:	
	The condition for passing the course is to obtain a positive grade in the written exam in the form of a single-choice test covering the material presented during the lecture.	

Exercise	**Methods of studies form:**	
	Laboratory exercise	
	Methods of verification:	**Involvement:**
	Colloquium	20%
	Report	70%
	Observation	10%
	Conditions for passing the course:	
	The credit for laboratory exercises is based on the completion of eight assigned exercises and the preparation of reports for them. The condition for credit is to obtain a positive grade for all reports and two colloquiums on the theory necessary to understand the exercises performed.	

Learning outcomes	**Methods of verification**			
	Written exam	Report	Colloquium	Observation
K1	X		X	
K2	X		X	
K3	X		X	
K4	X		X	
K5	X		X	
K6	X		X	
A1		X		
A2		X		
A3		X		
S1			x	x
S2		x		x
S3				x

5. Student workload – balance of hours and ECTS credits

Students activity		**Student workload Number of hours**
Classes conducted with the direct participation of an academic teacher or other persons conducting classes	Lecture	15
	Exercise	30

Student's own work	Preparing for classes	5
	Studying literature	10
	Preparing a report	16
	Preparing for an exam	5
Total student workload		81
ECTS		3

One (teaching) hour is 45 minutes.

6. Literature

The list of required and recommended literature will be provided by the lecturer at the first meeting.