

Subject name <b>Biophysics</b>	ECTS Code																
Name of unit teaching the subject <b>THE ZBIGNIEW RELIGA FACULTY OF MEDICAL SCIENCES IN ZABRZE, THE UNIVERSITY OF TECHNOLOGY IN KATOWICE</b>																	
<b>Studies</b>																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Field of study</th> <th style="width: 25%;">degree</th> <th style="width: 25%;">mode</th> <th style="width: 25%;">major</th> <th style="width: 20%;">specialization</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">medical</td> <td style="text-align: center;">Uniform Master's</td> <td style="text-align: center;">Stationary/non-stationary</td> <td></td> <td></td> </tr> </tbody> </table>	Field of study	degree	mode	major	specialization	medical	Uniform Master's	Stationary/non-stationary									
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Surname of instructor (instructors)																	
<b>Type of class, method of implementation and specified number of hours</b> <b>A. Type of class</b> <ul style="list-style-type: none"> <li>• <b>lecture,</b></li> <li>• <b>exercise classes,</b></li> <li>• clinical exercise classes</li> <li>• <b>seminars,</b></li> <li>• design classes</li> <li>• <b>laboratories,</b></li> <li>• lectureship,</li> <li>• diploma seminar,</li> <li>• professional internship.*</li> </ul> <p>* mark where applicable</p> <b>B. Method of implementation</b> <ul style="list-style-type: none"> <li>• <b>classes in a didactic room</b></li> <li>• on-line classes/<i>blended learning</i></li> <li>• classes outside the didactic room (in this case must specify where they are held)</li> </ul> <b>C. Amount of hours in accordance with the approved curriculum</b> Lecture – 20 hours Practical Classes – 30 hours Seminars – 10 hours	<b>Amount of ECTS points</b>  <b>Semester 02</b> -lecture – 20h -exercise/lab classes – 30h -seminars – 10h  <b>Description of awarding ECTS points:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 70%;">Activity</th> <th style="width: 30%;">Student workload</th> </tr> </thead> <tbody> <tr> <td>Participation in lectures</td> <td style="text-align: center;">20 hours</td> </tr> <tr> <td>Participation in practical classes</td> <td style="text-align: center;">30 hours</td> </tr> <tr> <td>Preparation for practical classes and colloquiums</td> <td style="text-align: center;">20 hours</td> </tr> <tr> <td>Seminars</td> <td style="text-align: center;">10 hours</td> </tr> <tr> <td>Consultations</td> <td style="text-align: center;">15 hours</td> </tr> <tr> <td><b>Total number of hours</b></td> <td style="text-align: center;">90 hours /30</td> </tr> <tr> <td><b>Amount of ECTS points per module</b></td> <td style="text-align: center;"><b>3ETCS</b></td> </tr> </tbody> </table>	Activity	Student workload	Participation in lectures	20 hours	Participation in practical classes	30 hours	Preparation for practical classes and colloquiums	20 hours	Seminars	10 hours	Consultations	15 hours	<b>Total number of hours</b>	90 hours /30	<b>Amount of ECTS points per module</b>	<b>3ETCS</b>
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<b>Subject status</b> <ul style="list-style-type: none"> <li>• <b>mandatory</b> / facultative</li> </ul>	<b>Language of instruction</b> Polish with simultaneous description of basic terminology in English																
<b>Didactic methods</b> <ul style="list-style-type: none"> <li>• presentation in accordance with the topic of exercise classes, seminars, lecture with the use of multimedia presentations,</li> <li>• orientation lecture</li> <li>• problem-focused learning</li> <li>• individual and group work</li> </ul>	<b>Forms and methods of passing and general grading criteria or examination requirements</b>  <b>A. Method of passing</b> <ul style="list-style-type: none"> <li>• examination</li> <li>• <b>passing with a grade*</b></li> </ul> <p>* mark where applicable</p>																

**B. Forms of passing:**

- written examination: test / with open questions (exercises)/longer written statement
- oral examination
- oral test/colloquium
- completion of a semester assignment: preparation of a design or presentation/conducting research and presenting its results(written/oral)/completion of a specified practical work
- **agreeing on a passing grade based on partial grades received during the course of the semester\***

\* mark where applicable

**C. Basic grading criteria**

All the provisions of the UTK Study Guidelines, Subject Guidelines as well as Workshop Guidelines shall apply. Participation in lectures, seminars, and exercise classes is mandatory. Each absence must be excused while material passed on a date and in a form agreed upon with the instructor

Theoretical preparation of the students for the topics of exercise classes and seminars

A grade of 3.0 or higher received from partial colloquiums during the course of the semester, encompassing material from lectures, seminars and exercise classes

Active participation in exercise classes and seminars

Keeping appropriate documentation of laboratory exercises (reports)

**Definition of preparatory subjects and initial requirements**

**A. Formal requirements:** familiarity with high school physics, biology, chemistry, mathematics

**B. Initial requirements:** it is required to master knowledge, abilities and competencies specified for the subjects listed above

**Subject aim**

C1: Familiarizing the students with the physical basics of the functioning of the locomotor system, sensory organs, circulatory system, central nervous system, electrical activity of the heart

C2: Familiarizing the students with the basic terms and phenomena of physics as far as biological systems on the level of biomolecules, biological membranes, cells and tissues

C3: Familiarizing the student with problems of medical physics as far as modern methods of diagnosis: ultrasonography, computed tomography, PET, nuclear magnetic resonance tomography, usage of lasers in medicine

**Curriculum****A. Lecture content**

W1: Biophysics – subject and range of interest. Force and the moment of force. Balance of forces in the musculoskeletal system – three types of levers

W2: Stretching and contraction of tissues, stresses, deformations, Hooke's law. Torsion and bending, bone fractures. Measurement of stress in bones during resistance tests

W3: Kinematics, kinetics, mechanics of liquids. Elements of liquid mechanics – biophysics of the circulatory and respiratory system. Aerodynamic and hydrodynamic resistance and flow parameters

W4: Work and energy. Bio-thermodynamics. Regulation of physiological processes. Acoustics – biophysics of hearing – ultrasounds and infrasounds. Basics of ultrasonography

W5: Direct current circuits. Work and force of electric current. Measurement of the resistance of human body

W6: Electric properties of cells –conductivity and electric potentials in the central nervous system

W7: The influence of mechanical factors on the organism (sound waves, accelerations, pressure, oscillations). Influence of electric current and electromagnetic fields on the organism

W8: Basics of geometrical optics – shortsightedness and farsightedness. Biophysics of visual processes

W10: Functioning of lasers, characteristics of laser radiation, Endoscopy. Calculating doses of laser radiation

W11: X-ray radiation- computed tomography. Nuclear magnetic resonance – uses in medicine

**B. Content of exercise classes**

L1: Defining the optical and focal power of convex lenses. Correction of near- and farsightedness

L2: Characteristics of laser radiation by defining wave length; setting the time of laser therapy depending on laser power

L3: Defining the Young module using the deflection method

L4: Measuring liquid viscosity using the Höppler viscometer  
 L5: Defining sound speed using the Kundt's tube  
 L6: Defining electric resistance using the Wheatstone bridge method  
 L7: Measuring the density of solids and liquids using a pycnometer  
 L8: Defining surface tension using the stalagmometric method  
 L9: Defining light refraction cofactor using the Abbe refractometer  
 L10: Defining Earth acceleration value using a mathematical pendulum

### C. Content of seminars

S1: Basics of ultrasonography  
 S2: Generating x-rays and their use in medicine  
 S3: Computed tomography  
 S4: Basics of laser functioning and their use in medicine  
 S5: Nuclear magnetic resonance tomography  
 S6: Electric current – influence on the human organism

### Literature

#### A. Literature required to receive a final credit for classes (pass an exam):

##### A.1 used in class

1. Biofizyka – wybrane zagadnienia wraz z ćwiczeniami, Grzegorz Bartosz, Zofia Józwiak, Wydawnictwo Naukowe PWN, 2015
2. Biofizyka, F. Jaroszyk, PZWL, 2016
3. Ćwiczenia laboratoryjne z biofizyki, ed. Józef Terlecki, PZWL, 1999

##### A.2 – studied independently by the student

1. Biocybernetyka i inżynieria biomedyczna 2000/ ed. by Maciej Nałęcz; vol. 9: Pawlicki G., Pałko T., Golnik N., Gwiazdowska B., Królicki L. (ed. Tomu), Fizyka medyczna. Polska Akademia Nauk – Warszawa: Akademia Oficyna Wydawnicza EXIT, 2002
2. Bendek G.B., Villars F.M.H., Physics with Illustrative Examples From Medicine and Biology, Mechanics. 2<sup>nd</sup> Edition, New York, Springer Verlag, 2000

#### B. Supplementary literature

1. Kate S.A., Introduction to Physics in Modern Medicine. London Taylor&Francis, 2003
2. Herman I.P., Physics of the Human Body. Berlin Heidelberg, Springer Verlag, 2007

### Educational effects:

Effect no	Description of an educational effect	Reference to field of study related effects
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### Knowledge:

W1	Student knows the laws of physics describing the flow of liquid as well as factors influencing the vessel resistance of blood flow	B.W5
W2	Student knows the physicochemical and molecular basis of the functioning of the sensory organs	B.W7
W3	Student knows the natural and artificial sources of ionizing radiation	B.W6
W4	Student knows the physical basis of noninvasive imaging methods	B.W8
W5	Student knows the physical basis of selected therapeutic techniques including ultrasounds and irradiation	B.W9
W6	Student knows the physical basis of stimulation and conductivity in the central nervous system	B.W20

### Abilities:

U1	Student can use simple measuring devices and estimate the accuracy of the measurements taken	B.U9
U2	Student evaluates the harmfulness of ionizing radiation dosage and follows the principles of radiologic protection	B.U2
U3	Student plans and performs simple scientific research and interprets their results and draws conclusions	B.U13

### Methods used in the verification of educational effects

Educational effect	Type of grade				
	colloquiums	Solving problems during exercise classes	Solving problems in groups	Oral examination	Written examination
W1	X		X		
W2	X		X		
W3	X	X			
W4	X	X			
U1	X		X		
U2	X				
U3	x		x		

Criteria of evaluating educational effects					
Educational effect	For a grade of 3	For a grade of 3.5	For a grade of 4	For a grade of 4.5	For a grade of 5
W1	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%	Exhibits familiarity with the educational content on a level of 77%-84%	Exhibits familiarity with the educational content on a level of 85%-92%	Exhibits familiarity with the educational content on a level of 93%-100%
W2	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%	Exhibits familiarity with the educational content on a level of 77%-84%	Exhibits familiarity with the educational content on a level of 85%-92%	Exhibits familiarity with the educational content on a level of 93%-100%
W3	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%	Exhibits familiarity with the educational content on a level of 77%-84%	Exhibits familiarity with the educational content on a level of 85%-92%	Exhibits familiarity with the educational content on a level of 93%-100%
W4	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%	Exhibits familiarity with the educational content on a level of 77%-84%	Exhibits familiarity with the educational content on a level of 85%-92%	Exhibits familiarity with the educational content on a level of 93%-100%
U1	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%	Exhibits familiarity with the educational content on a level of 77%-84%	Exhibits familiarity with the educational content on a level of 85%-92%	Exhibits familiarity with the educational content on a level of 93%-100%
U2	Exhibits familiarity	Exhibits familiarity	Exhibits familiarity	Exhibits familiarity	Exhibits familiarity with the educational

	with the educational content on a level of 60%-69%	with the educational content on a level of 70%-76%	with the educational content on a level of 77%-84%	with the educational content on a level of 85%-92%	content on a level of 93%-100%
<b>U3</b>	Exhibits familiarity with the educational content on a level of 60%-69%	Exhibits familiarity with the educational content on a level of 70%-76%			Exhibits familiarity with the educational content on a level of 93%-100%