

**MINISTRY OF HIGHER EDUCATION, SCIENCE AND  
INNOVATION OF THE REPUBLIC OF UZBEKISTAN**

**MINISTRY OF HEALTHCARE OF  
THE REPUBLIC OF UZBEKISTAN**

**TASHKENT MEDICAL ACADEMY**



**SYLLABUS ON SUBJECT  
MEDICAL AND BIOLOGICAL PHYSICS  
For daytime study**

**Field of knowledge:** 900 000 –Healthcare and social affairs  
**Branch of education:** 910 000 –Healthcare  
**Educational directions:** 60910200 –General medicine (for international students)

**Tashkent 2023**



**Module / Syllabus of the subject**  
**Management, medical biology, biomedical engineering**  
**and HN faculty**  
**60910200 - Medical work educational direction**

<b>Item name:</b>	<b>Medical and biological physics</b>
<b>Item Type:</b>	<b>Required</b>
<b>Item code:</b>	TBF1205
<b>Year :</b>	<b>2023/2024</b>
<b>Semester:</b>	<b>2</b>
<b>Form of study:</b>	<b>Daytime</b>
<b>Form of classes and hours allocated for the semester:</b>	
Lectures	<b>14</b>
Practical work	<b>46</b>
Laboratory works	<b>15</b>
Seminar	-
Independent education	<b>75</b>
<b>Amount of credits:</b>	<b>5</b>
<b>Evaluation method:</b>	<b>credits</b>
<b>Subject language:</b>	<b>English</b>

<b>Purpose of the item (PI)</b>	
<b>PI1</b>	<p>To teach students the theoretical and practical knowledge necessary for the correct interpretation of physiological processes in the activity of organs and systems of the body, to see the primacy of physical changes based on the processes of occurrence of various diseases in the organs and tissues of the body - to show.</p> <p>To achieve this goal, the module fulfills the tasks of forming students' theoretical knowledge, practical skills and methodological approach to processes and scientific worldview.</p>

<b>Basic knowledge required to master science</b>	
<b>1.</b>	Medical biology
<b>2.</b>	Histology
<b>3.</b>	Biochemistry
<b>4.</b>	Human anatomy

<b>Educational results (ER)</b>	
	<b>By knowledge:</b>
<b>ER 1</b>	The importance of the medical and biological physics module in the work of a general practitioner should be shared;
<b>ER 2</b>	must know the general physical and biophysical laws underlying the activity of organs and tissues of the body;
<b>ER 3</b>	must have a thorough understanding of the mechanical, bioelectrical and optical properties and properties of body tissues and fluids;
<b>ER 4</b>	must have knowledge about the basic biophysical mechanisms of physical healing and the negative influences of the external environment;
<b>ER 5</b>	Must know the basic physical principles embodied in the operation of medical devices.
	<b>By skills:</b>
<b>ER 6</b>	Medical and biological physicists must be able to apply laws to the processes of a living organism;
<b>ER 7</b>	Knowledge of sanitary inspection and description of premises, measurement and assessment of indoor air microclimate indicators;
<b>ER 8</b>	He must have the skills to obtain, record and analyze medical and biological data using physical and technical means;
<b>ER 9</b>	Full knowledge of the terminology of medical and biological physics, mastering the practice of knowing the mechanical properties of biological tissues;
<b>ER10</b>	know the viscosity of biological fluids and the meaning of viscosity in the body and be able to determine it.

<b>Item content:</b>	
<b>Form of teaching: lecture (L)</b>	
<b>L1</b>	Mechanical properties of solids and biological tissues.
<b>L2</b>	Basics of acoustics. The use of sound in medicine.
<b>L3</b>	Hemodynamics. Physical foundations of cardiac hemodynamics.
<b>L4</b>	Thermodynamics. Thermodynamics of living systems.
<b>L5</b>	Optics. Light properties.
<b>L6</b>	Radioactivity. The influence of ionizing radiation on living organisms.
<b>L7</b>	Modern visualization methods.

<b>Form of training: practical classes (P)</b>	
<b>P1</b>	Physical quantities and units of measurement. Error theory.
<b>P2</b>	Acoustics. Physical properties of sound. Physical properties of the hearing organs. Determination of the hearing threshold.
<b>P3</b>	Viscosity of biological fluids. The value of viscosity in medicine.
<b>P4</b>	Determination of viscosity by the Stokes method.

<b>P5</b>	Determination of surface tension by drop separation method.
<b>P6</b>	Study of the application of the laws of thermodynamics to living organisms. Determination of heat capacity coefficients by the Clément-Desormes method.
<b>P7</b>	Electrical conductivity of biological fluids and tissues at direct current. Aeroions and their therapeutic and prophylactic effects.
<b>P8</b>	Calibration of a thermocouple and investigation of its use as a thermometer.
<b>P9</b>	Registration of biopotentials. Study of the physical foundations of electrography.
<b>P10</b>	Determining the wavelength of light using a diffraction grating.
<b>P11</b>	Determination of optical density and conductivity of a liquid using a photoelectrocolorimeter.
<b>Form of training: laboratory classes (L)</b>	
<b>L1</b>	Determination of Young's modulus of solids and biological tissues.
<b>L2</b>	Determination of the viscosity of an unknown liquid using an Oswald-Pinkevich viscometer.
<b>L3</b>	Study of the physical principles of measuring blood pressure in the clinic.
<b>L4</b>	Determination of air humidity using an Assmann psychrometer.

<b>Independent education (IE)</b>		<b>hour</b>
1	Basics of bionics and its role in human life.	4
2	Elements of biophysics of hearing. Basics of cochlear implantation.	4
3	Radio wave surgery	4
4	Biorheology. Viscosity of biological fluids. Use of viscosity in the clinic	4
5	Laminar and turbulent flows. Reynolds number.	4
6	Surface tension of liquids. Air-gas embolism	4
7	Electric and magnetic fields and their influence on living organisms.	4
8	Physical foundations of electrographic methods (EEG, EMG).	4
9	Low- and high-frequency physiotherapeutic devices. The physical basis of their action.	4
10	The law of refraction and return of your light. Application of refractometric methods in the practice of medical diagnostics.	4
11	The optical system of the eye and its physical properties.	4
12	Use of endoscopic methods in medicine.	4
13	Application of laser in medicine.	4

14	Physical processes in biological membranes.	4
15	Computed tomography and the physical basis of its work.	4
16	Physical basis of magnetic resonance imaging.	3
17	Positron emission tomography.	3
18	Basics of Elastography.	3
19	Lithotripsy	3
20	Application of laparoscopy in surgery	3

<b>Basic literature:</b>		
1	Paul Davidovits Physics in Biology and Medicine (third edition). 2008.	
2	Basics of Medical physics and Biophysics and Biophysics for electronic education of health professionals.Kukurova Elena at all, Asklepios, 2013.	
3	Fundamentals of Biophysics 2014. Andrey B.Rubin. Willey	
<b>Additional literature</b>		
1	Fundamental Concepts in Biophysics Thomas Jue 2016, Humana press.	
2	Applied Biophysics: a molecular Approach for Physical scientists. Tom Waigh, 2007 y. Willey	
3	An introduction to medical Biophysics. Parveen Parkash government Medical College, India, 1998 y.	
<b>Internet sites:</b>		
1	<a href="https://www.biophysics.org/what-is-biophysics">https://www.biophysics.org/what-is-biophysics</a>	
2	<a href="https://lsa.umich.edu/biophysics/about-us/what-is-biophysics.html">https://lsa.umich.edu/biophysics/about-us/what-is-biophysics.html</a>	
3	<a href="https://www.springer.com/journal/11439">https://www.springer.com/journal/11439</a>	
4	<a href="https://gsas.harvard.edu/programs-of-study/all/biophysics">https://gsas.harvard.edu/programs-of-study/all/biophysics</a>	
5	<a href="https://physicsworld.com/c/biophysics-bioengineering/">https://physicsworld.com/c/biophysics-bioengineering/</a>	
6	<a href="https://biophysics.berkeley.edu/">https://biophysics.berkeley.edu/</a>	
7	<a href="https://www.cell.com/biophysj/home">https://www.cell.com/biophysj/home</a>	

**In monitoring students' mastery of the subject  
It is recommended to use the following criteria:**

Ball	ECTS Grade	Определение ECTS		Grade	Definition
90-100	A	"Great"	<p>have systematic, complete and deep knowledge of all sections of the module program, be able to substantiate them with the necessary evidence;</p> <p>can clearly and appropriately use medical terminology (including scientific, foreign), can answer questions logically, clearly and concisely; <b>ВЫЯВИТЬ</b> проблемные вопросы, обосновать your point of view in scientific and practical language;</p> <p>know the basic concepts of the module and be able to effectively apply it when solving scientific and practical problems in a short time;</p> <p>able to demonstrate the ability to independently and creatively solve problems in non-routine situations;</p> <p>is able to fully independently perform practical skills (in terms of quality and established quantity) and fully acquire competencies;</p> <p>solving practical problems briefly, reasonably and rationally;</p> <p>demonstrate in practical classes a very good knowledge of physical laws, be able to correctly (always rationally) apply this knowledge in new situations, be able to independently formalize the results of the work performed;</p> <p>complete and in-depth mastery of basic and additional literature recommended in the module program;</p> <p>understand the essence of the theories, concepts and directions of the module, give them a critical assessment and be able to apply the scientific achievements of other modules;</p> <p>must creatively and independently participate in theoretical and practical classes throughout the semester, be</p>	5	Great

			active in group discussions, and have a high level of culture in completing assignments;		
85-89	B+	"Very good"	<p>have systematic, complete and deep knowledge of all sections of the module program, be able to substantiate them with the necessary evidence;</p> <p>can clearly and correctly use medical terminology (including scientific and foreign), can answer questions logically and accurately;</p> <p>способен самостоятельно eliminate ambiguities that arise when proving your opinion or explaining other theoretical material;</p> <p>know the basic concepts of the module, set scientific and professional tasks in a short period of time and effectively use it in solving them;</p> <p>is able to independently solve problems in standard situations within the framework of the curriculum;</p> <p>is able to fully independently perform practical skills (in terms of quality and established quantity) and fully acquire competencies;</p> <p>demonstrate good knowledge of physical laws in practical classes, be able to correctly (but not always rationally) apply this knowledge in new situations, be able to adequately formalize the results of the work performed;</p> <p>mastering the basic literature recommended in the module program;</p> <p>be able to understand the essence of the theories, concepts and trends of the module being studied and give them a critical assessment;</p> <p>must creatively and independently participate in theoretical and practical classes throughout the semester, be active in group discussions, have a very good level of culture in completing assignments;</p>	4	Good

71-84	B	«good»	<p>have a systematic, complete and in-depth knowledge of all sections of the module program, be able to justify it with the necessary evidence, but with some shortcomings;</p> <p>can clearly and correctly use medical terminology (including scientific and foreign), can answer questions logically;</p> <p>is able to independently eliminate ambiguities that arise when proving his opinion or explaining other theoretical material;</p> <p>know the basic concepts of the module, set scientific and professional tasks in a short period of time and effectively use it in solving them;</p> <p>is able to independently solve problems in standard situations within the framework of the curriculum;</p> <p>is able to independently perform practical skills (in terms of quality and established quantity) and acquire competencies, but with some shortcomings;</p> <p>demonstrate good knowledge of physical laws in practical classes, be able to correctly (but not always rationally) apply this knowledge in new situations, without being able to sufficiently independently formalize the results of the work performed;</p> <p>mastering the basic literature recommended in the module program;</p> <p>be able to understand the essence of the theories, concepts and directions of the module being studied;</p> <p>must creatively and independently participate in theoretical and practical classes throughout the semester, be active in group discussions, and have a good level of assignment completion;</p>	3,5	
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60-70	C	<p>“satisfactory” - unsatisfactory result, with gross defects.</p>	<p>have sufficient knowledge within the module program; use medical terminology, correctly explain answers to questions, but make mistakes; demonstrate a basic understanding of the module when difficult to answer, or demonstrate some specific skills; is able to perform practical skills (in terms of quality and quantity given) independently, but completely with errors; acquiring competencies independently, but with errors; have partial knowledge of the general concepts of the module and be able to apply it when solving standard (model) situations; be able to solve standard situations with the help of a teacher; understand the essence of the main theories, concepts and directions of the module being studied; it is necessary to participate in theoretical and practical classes under the guidance of a teacher, to have a sufficient level of culture in completing tasks;</p>	3	satisfactory
0-59	F	"unsatisfied"	<p>if he has only fragmentary knowledge within the framework of the module program; does not use medical terms or makes serious and gross logical errors when answering questions or does not answer at all; if he passively participates in theoretical and practical classes and has a low level of culture in completing tasks or does not perform them at all; if he does not have practical skills and competencies, if he cannot correct his mistakes even with the help of the recommendations of the teaching staff.</p>	2	unsatisfied

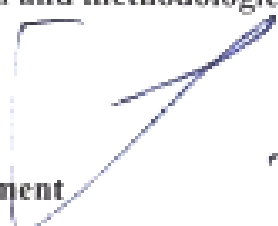
### Information about the subject teacher

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This syllabus was approved by the minutes of the meeting of the TTA Educational and Methodological Council 2023.

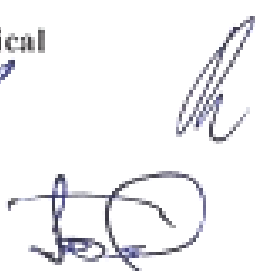
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**Head of educational and methodological  
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**F.Kh.Azizova**

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