

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation



WORKING PROGRAM

Name of the academic discipline: **PHYSICS**

Specialty: **33.05.01 PHARMACY**

Qualification: **PHARMACIST**

Department: **MEDICAL BIOPHYSICS**

Mode of study: **FULL-TIME**

Labor intensity of the academic discipline: **108 academic hours**

Nizhny Novgorod
2021

The working program has been developed in accordance with the Federal State Educational Standard for specialty 33.05.01 PHARMACY approved by Order of the Ministry of Science and Higher Education of the Russian Federation No. 219 of March 27, 2018.

Developers of the working program:

D.I. Iydin, Ph.D. (Physical and Mathematical Sciences), Ph.D. (Biology), Professor, Head of the Department of Medical Biophysics of Federal State Budgetary Educational Institution of Higher Education «Privolzhsky Research Medical University» of the Ministry of Health of the Russian Federation


S.L. Malinovskaya, Ph.D. (Biology), Professor of the Department of Medical Biophysics of Federal State Budgetary Educational Institution of Higher Education «Privolzhsky Research Medical University» of the Ministry of Health of the Russian Federation

The program was reviewed and approved at the department meeting of the Department of Medical Biophysics (protocol No. 9, April 15, 2021)

Head of the Department of Medical Biophysics,

Ph.D. (Physical and Mathematical Sciences), Ph.D. (Biology),

Professor



(signature)

D.I. Iydin

April 15, 2021

AGREED

Deputy Head of EMA ph.d. of biology



Lovtsova L.V.

(signature)

April 15, 2021

1. The purpose and objectives of mastering the academic discipline «Physics» (hereinafter – the discipline):

1.1. **The purpose of mastering the discipline:** participation in the formation of the competencies of UC-1, GPC -1, consisting in the formation of students' ability to carry out a critical analysis of problem situations based on a systematic approach, develop a strategy of actions and the ability to use basic biological, physico-chemical, mathematical methods for the development, research and examination of medicines.

1.2. Tasks of the discipline:

- formation of students' logical thinking, the ability to accurately formulate a task, the ability to isolate the main and secondary, the ability to draw conclusions based on the obtained measurement results;
- teaching students the methods of laboratory measurements of the physical characteristics of the substance under study, which are used in pharmacy and obtaining the necessary information from the data obtained, compliance with safety standards, including electrical safety during a physical experiment.

1.3. Requirements to the deliverables of mastering the discipline

As a result of completing the discipline, the student should

Know:

- basic laws of modern physics;
- theoretical foundations of physical methods of substance analysis;
- characteristics of physical factors and mechanisms of their action on the body;
- metrological requirements when working with physical equipment;
- safety rules when working with the equipment;
- the latest achievements in the field of physics and prospects for their use in various fields of pharmacy.

Be able to:

- analyze the life processes of biosystems using the laws of physics;
- the technique of working on physical devices used for quantitative and qualitative analysis of the substance;
- to justify the choice of a physical factor acting on the body for diagnostic and therapeutic purposes;
- to choose the optimal method of quantitative and qualitative analysis of a substance using appropriate physical devices and apparatuses.

Possess:

- methods of measuring physical quantities;
- methods of colorimetry, polarimetry, spectrophotometry and refractometry;
- abstract thinking methodology for making conclusions about the results of measurements of the physical characteristics of biological objects and mathematical processing of the data obtained;
- skills of practical use of instruments and equipment in the physical analysis of a substance;
- skills of obtaining information from various sources.

2. Position of the academic discipline in the structure of the General Educational Program of Higher Education (GEP HE) of the organization.

2.1. The discipline «Physics» refers to the core part of Block 1 (B1.E.9) of GEP HE. The discipline is taught in 2 semester/1year of study.

2.2. The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline:

- school physics course.

2.3. Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines:

- biology;
- physiology;
- biological chemistry;
- physical and colloidal chemistry;
- microbiology;
- general hygiene.

3. Deliverables of mastering the academic discipline and metrics of competence acquisition

Mastering the discipline aims at acquiring the following universal (UC) or/and general professional (GPC) or/and professional (PC) competencies

№	Competence code	The content of the competence (or its part)	Code and name of the competence acquisition metric	As a result of mastering the discipline, the students should:		
				know	be able to	possess
1.	UC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy	<p><u>ID-1 UC-1.1.</u> Knows: methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis</p> <p><u>ID-2 UC-1.2.</u> Able to: gain new knowledge based on analysis, synthesis, etc.; collect data on complex scientific problems related to the professional field; search for information and solutions based on action, experiment and experience</p>	methods of systematic and critical analysis; methods of developing action strategies for identifying and solving a problem situation	apply the methods of a systematic approach and critical analysis of problem situations; develop a strategy of actions, make concrete decisions for its implementation	methodology of systematic and critical analysis of problem situations; methodology of goal setting, determination of ways to achieve it, development of action strategies.
2.	GPC -1	Able to use basic biological, physico-chemical, mathematical methods for the development, research and examination of medicines.	<u>ID-1 GPC-1.2.</u> Applies basic physico-chemical methods of analysis for the development, research and examination of medicines and medicinal plant raw materials.	The basic laws of modern physics. Theoretical foundations of physical methods of substance analysis. Characteristics of physical factors and mechanisms of their action on the organism. Metrological	Analyze the life processes of biosystems using the laws of physics. Technical work on physical devices used for quantitative and qualitative analysis of the material. To justify the choice of a	Methods of measuring physical quantities. Methods of colorimetry, polarimetry, spectrophotometry and refractometry. The method of abstract thinking to make a conclusion about the results of

				requirements when working with physical equipment. Safety precautions when working with equipment. The latest achievements in the field of physics and the prospects of their use in various areas of pharmacy.	physical factor acting on the organ with a diagnostic and therapeutic purpose. Choose the optimal method of quantitative and qualitative analysis of the substance, using appropriate physical devices and apparatuses.	measurements of the physical characteristics of biological objects and mathematical processing of the data obtained. Skills of practical use of devices and equipment in the physical analysis of the substance. Skills of obtaining information from various sources.
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* *Competence achievement indicator – a set of planned learning outcomes in disciplines (modules) and practices that ensure the formation of all graduate competencies established by the specialty program. These are generalized characteristics that clarify and reveal the formulation of competence in the form of specific actions performed by a graduate who has mastered this competence. Indicators should be comparable to labor functions and/or labor actions (professional standard), but not equal to them. Indicators of competence achievement should be measured using the means available in the educational process.*

4. Sections of the academic discipline and competencies that are formed when mastering them:

№	Competence code	Section name of the discipline	The content of the section in teaching units
1.	UC-1 GPC -1	Mechanics.	Mechanics of rotational motion. Centripetal acceleration. Centrifugal force. Moment of inertia. A moment of power. Lever. Conditions of equilibrium of a solid body. Physical fundamentals of centrifugation and weighing. Mechanics of viscous fluid. The profile of the current velocities of a viscous liquid. Newton's and Poiseuille's laws. Reynolds number. Hydraulic resistance. Serial and parallel connection of tubes. Resistance of the hydraulic system. Mechanical vibrations and waves. A flat wave. The Doppler effect. Acoustics. Objective (physical) characteristics of sound. Acoustic impedance. Propagation of a sound wave in an acoustically homogeneous medium. Propagation of a sound wave in an acoustically inhomogeneous medium (the wavelength is greater than the size of the inhomogeneity, of the order of the size of the inhomogeneity, less than the size of the inhomogeneity). Infrasound, sound, ultrasound. Physical features of ultrasound with frequencies of the order of one megahertz. Sonocavitation.
2.	UC-1	Molecular physics, thermodynamics.	Methods of molecular kinetic theory and thermodynamics. Boltzmann and Maxwell distributions. Temperature, heat capacity. Molar heat capacities of gases. Mechanics and thermodynamics of real gases.

	GPC -1		Interaction between gas molecules. The Van der Waals equation. Isotherms of real gases. Critical point. Features of the molecular structure of liquids.
3.	UC-1 GPC -1	Electricity and magnetism.	<p>Electrical resistance of a substance. Active resistance. Reactance of inductive and capacitive components of electrical circuits. Ohm's law for alternating current circuits. The impedance of electrical circuits containing capacitive, inductive and resistive components. Electrical conductivity and active resistance of electrolytes, capacitive properties of membranes.</p> <p>Characteristics of electric and magnetic fields. Dielectric constant. Dielectrics in a constant and alternating electric field.</p> <p>Magnetic properties of the substance. Electromagnetic waves. The scale of electromagnetic waves. The effect of high-frequency and ultra-high-frequency electric and magnetic fields on dielectrics and conductors. The effect of ultrahigh frequency electromagnetic fields on matter.</p> <p>Electric dipole, current dipole.</p> <p>The causes of the irritating effects of direct and alternating currents. Dangerous values of currents and voltages, frequency dependences of the thresholds of tangible and non-emitting currents.</p>
4.	UC-1 GPC -1	Optics.	<p>Geometrical optics, conditions of application of methods of geometrical optics. Laws of refraction and reflection of light. The phenomenon of complete internal reflection. Fiber optics. Magnifying glass, microscope and eye as optical systems.</p> <p>Wave optics. Interference of light. Diffraction of light. The Huygens-Fresnel principle. Diffraction grating. Diffraction spectrum. Application of a diffraction grating in spectral devices. Resolution of optical devices (diffraction grating, microscope). Special microscopy methods.</p> <p>Light absorption. Booger's law. Baer's law. The Booger-Lambert-Baer law. Molar absorption coefficient, its physical meaning. Optical density. Polarization of light. Natural and polarized light. Polarization during reflection and refraction of light at the boundary of two dielectrics. Brewster's law. Polarization at double refraction of substances. Rotation of the polarization plane by optically active substances. Dispersion of optical activity. Polarimeters and their application for the study of optically active substances.</p> <p>Thermal radiation of bodies. Absolutely black body, gray body. The spectrum of radiation of a completely black body. The laws of Kirchhoff, Boltzmann, Wine. The spectrum of solar radiation.</p>
5.	UC-1 GPC -1	Quantum physics. Spectroscopy.	<p>The wave function and its physical meaning. The Schrodinger equation. His solution is for special cases. Quantum mechanical model of the atom.</p> <p>Electronic energy levels of atoms and molecules. Molecular spectra (vibrational and rotational). IR spectroscopy. Application of spectral analysis. Absorption spectra of molecules of some biologically active compounds.</p> <p>Spectrophotometry. Luminescence. Stokes' law for photoluminescence. Luminescence spectra. Luminescent microscopy. Chemiluminescence, mechanisms of its generation, application in biomedical analysis.</p> <p>Forced radiation. Lasers. Features of laser radiation.</p> <p>Biological effects of ultraviolet radiation, light, infrared radiation.</p>
6.	UC-1 GPC -1	Physics of ionizing radiation.	<p>Types of ionizing radiation. Mechanisms of interaction of corpuscular ionizing radiation with matter. Primary and secondary interactions. Track particles. Linear braking capacity, linear ionization density, average linear mileage. Interaction of X-ray and gamma radiation with matter. Reactions of photons with matter (elastic scattering, Compton scattering, photoelectric effect, generation of electron-positron pairs). The attenuation coefficient of the photon flux. Dependence of the attenuation coefficient on the photon energy. Ionizing radiation dosimetry: absorbed exposure and equivalent doses. Protection against ionizing radiation. Ionizing radiation detectors.</p>

5. Volume of the academic discipline and types of academic work

Type of educational work	Labor intensity		Labor intensity (AH) in semesters
	volume in credit units (CU)	volume in academic hours (AH)	
<i>Classroom work, including</i>	1,8	66	66
Lectures (L)	0,4	14	14
Laboratory practicum (LP)*	1,4	52	52
Practicals (P)	<i>FSES are not provided</i>		
Seminars (S)	<i>FSES are not provided</i>		
<i>Student's individual work (SIW)</i>	1,2	42	42
Mid-term assessment			
CREDIT			
TOTAL LABOR INTENSITY	3	108	108

6. Content of the academic discipline

6.1. Sections of the discipline and types of academic work

№	Semester No.	Name of the section of the academic discipline	Types of academic work* (in AH)					total
			L	LP	P	S	SIW	
1.	2	Mechanics.	4	12			6	22
2.	2	Molecular physics, thermodynamics.					8	8
3.	2	Electricity and magnetism.	2	12			8	22
4.	2	Optics.	3	15			8	26
5.	2	Quantum physics. Spectroscopy.	3	7			8	18
6.	2.	Physics of ionizing radiation.	2	6			4	12
		CREDIT						
		TOTAL	14	52			42	108

* - L – lectures; LP – laboratory practicum; P – practicals; S – seminars; SIW – student's individual work.

6.2. Thematic schedule of educational work types:

6.2.1. Thematic schedule of lectures

№	Name of lecture topics	Volume in AH
		Semester 1
1.	Mechanics of rotational motion. Centripetal acceleration. Centrifugal force. Conditions of equilibrium of a solid body. Physical fundamentals of centrifugation and weighing.	1
2.	Mechanics of viscous fluid. Newton's equation. The Poiseuille formula. The profile of the current velocities of a viscous liquid. Hydraulic resistance of series and parallel connected tubes.	1
3.	Mechanical vibrations and waves. Spherical, cylindrical, plane waves. The wave front. The plane wave equation. The Doppler effect.	0,5
4.	Acoustics. Propagation of a sound wave in an acoustically homogeneous medium. Acoustic impedance. Objective (physical) and subjective (physiological) characteristics of sound.	1
5.	Infrasound. Ultrasound.	0,5
6.	The total resistance of the AC electrical circuit. Ohm's law for alternating current circuits. The impedance of electrical circuits containing capacitive, inductive and resistive components. Active and reactive electrical resistance of biological tissues.	1
7.	Electromagnetic waves. The scale of electromagnetic waves. The effect of UV, visible light, IR, UHF and microwave electromagnetic fields on the substance.	1

8.	Geometric optics. Conditions for the application of geometric optics methods. The course of rays in an optical microscope. Magnification of the microscope.	1
9.	Wave optics. The resolution of the microscope. Special microscopy methods. Diffraction spectrum. Application of a diffraction grating in spectral devices.	2
10.	Physical fundamentals of spectroscopy. Emission spectra and absorption spectra. Molecular spectra (vibrational and rotational). IR spectroscopy. Application of spectral analysis. Absorption spectra of some biologically important molecules. Spectrophotometry.	1
11.	Luminescence. Types of luminescence. Photoluminescence. Chemiluminescence, mechanisms of its generation, application in biomedical analysis. Spectrofluorimetry. Luminescent microscopy.	1
12.	Forced radiation, lasers. Features of laser radiation.	1
13.	Physics of ionizing radiation. The laws of interaction of X-ray and gamma radiation with matter. Primary and secondary interactions of corpuscular ionizing radiation. Track particles. Protection against ionizing radiation. Ionizing radiation detectors.	2
	<i>TOTAL (total - AH)</i>	<i>14</i>

6.2.2. The thematic plan of laboratory practicums

№	Name of laboratory practicums	Volume in AH
		Semester 2
1	Study of mechanical vibrations.	3
2	Determination of the viscosity of a liquid by the Stokes method.	3
3	Determination of liquid viscosity by Ostwald method.	3
4	Study of elastic properties of materials.	3
5	Measurement of the total resistance in the AC circuit.	3
6	Sensors of physical quantities, thermocouples, thermistors.	3
7	Measurement of electrical circuit impedance.	3
8	Measurement of the dipole moment of a current dipole.	3
9	Microscopy.	3
10	Special microscopy techniques.	3
11	Refractometry.	3
12	Polarimetry methods.	3
13	Measuring the wavelength of light, study of the diffraction spectrum and characteristics of the diffraction grating	3
14	Lasers. Features of laser radiation.	3
15	Physical fundamentals of spectrophotometry and spectrofluorimetry.	4
16	Dosimetry of ionizing radiation	3
17	Protection against ionizing radiation	3
	<i>TOTAL (total - AH)</i>	<i>52</i>

6.2.3. Thematic plan of practicals

- *FSES are not provided.*

6.2.4. Thematic plan of seminars

- *FSES are not provided.*

6.2.5. Types and topics of student's individual work (SIW)

№ п/п	Types and topics of SIW	Volume in AH
		semester 2
1	<u>Mechanics.</u> <i>Independent work with educational literature, work with electronic sources of information, with professional Internet resources to prepare for practical and credit classes. HW, DEW</i>	6
2	<u>Molecular physics, thermodynamics.</u> <i>Work with literature sources; preparation for classes in an interactive form; preparation for boundary control, including work with electronic educational resources (computer testing in on-line mode on the website of distance education of PIMU). HW, DEW</i>	8
3	<u>Electricity and magnetism.</u> <i>Work with literature sources; preparation for classes in an interactive form; preparation for boundary control, including work with electronic educational resources (computer testing in on-line mode on the website of distance education of PIMU). HW, DEW</i>	8
4	<u>Optics.</u> <i>Independent work with educational literature to prepare for practical and credit classes, work with electronic sources of information, professional Internet resources. HW, DEW</i>	8
5	<u>Quantum physics. Spectroscopy.</u> <i>Work with literature sources; preparation for classes in an interactive form; preparation for boundary control, including work with electronic educational resources (computer testing in on-line mode on the website of distance education of PIMU). HW, DEW</i>	8
6	<u>Physics of ionizing radiation.</u> <i>Independent work with educational literature to prepare for practical and credit classes, work with electronic sources of information, with professional Internet resources. HW, DEW</i>	4
	<i>TOTAL (total – AH)</i>	42

****Types of independent work:** work with literary and other sources of information on the section under study, including in an interactive form, homework (HW), work with electronic educational resources posted on the educational portal of the University, distance education website (DEW), etc.

7. Types of assessment formats for ongoing monitoring and mid-term assessment

№	Semester No.	Types of control	Name of section of academic discipline	Competence codes	Assessment formats			
					types	number of test questions	number of test task options	
1.	2	Current monitoring	Control of mastering the topic	Mechanics.	UC-1 GPC -1	Test	30	20 - Computer testing (the variant is formed by random sampling)
						Testing of practical skills.	3	20
						Interview	2	50
						Writing a test paper (or preparing an audio report)	8	45
2.	2	Current monitoring	Control of mastering the topic	Molecular physics, thermodynamics.	UC-1 GPC -1	Test tasks. Oral individual survey.	30	20 - Computer testing (the variant is formed by random sampling)
						Current testing. Control work.	6	12
						Current testing. Oral individual survey.	20	50

			Monitoring the student's individual work			Writing a report on an individual task (or preparing an audio report).	20	12
3.	2	Current monitoring	Control of mastering the topic	Electricity and magnetism.	UC-1 GPC -1	Test tasks. Oral individual survey.	30	20 - Computer testing (the variant is formed by random sampling)
						Current testing. Control work.	6	12
			Current testing. Oral individual survey.			20	30	
			Monitoring the student's individual work			Writing a report on an individual task (or preparing an audio report).	20	12
4.	2	Current monitoring	Control of mastering the topic	Optics.	UC-1 GPC -1	Test tasks. Oral individual survey.	20	20 - Computer testing (the variant is formed by random sampling)
						Current testing. Control work.	6	12
			Current testing. Oral individual survey.			20	30	
			Monitoring the student's individual work			Writing a report on an individual task (or preparing an audio report).	20	12
5.	2	Current monitoring	Control of mastering the topic	Quantum physics. Spectroscopy.	UC-1 GPC -1	Test tasks. Oral individual survey.	20	20 - Computer testing (the variant is formed by random sampling)
						Current testing. Control work.	6	12
			Current testing. Oral individual survey.			20	30	
			Monitoring the student's individual work			Writing a report on an individual task (or preparing an audio report).	20	12
6.	2	Current monitoring	Control of mastering the topic	Physics of ionizing radiation.	UC-1 GPC -1	Test tasks. Oral individual survey.	20	20 - Computer testing (the variant is formed by random sampling)
						Current testing. Control work.	6	12
			Current testing. Oral individual survey.			20	30	
			Monitoring the student's individual work			Writing a report on an individual task (or preparing an audio report).	20	12
7.	2	Mid-term assessment	CREDIT	All sections	UC-1 GPC -1	Test tasks.	200	Computer testing (the variant is formed by random sampling)
						Oral individual survey.	4	12

8. Educational, methodological and informational support for mastering the academic discipline (printed, electronic publications, the Internet and other network resources)

8.1. Key literature references

№	Name according to bibliographic requirements	Number of copies	
		at the department	in the library
1.	Raymond A. Serway, John W. Jewett . Physics for Scientists and Engineers with Modern Physics, 10th Edition, 2019.- 1254 p.		
2.	Miles Hudson. Pearson Edexcel International Advanced Level (IAL) Physics Student Book and ActiveBook 1, 2018.- 224 p.		
3.	Miles Hudson. Pearson Edexcel International Advanced Level (IAL) Physics Student Book and ActiveBook 2, 2018.- 224 p.		
4.	Michael Nelkon. Advanced Level Physics, 7th Edition, 1996.- 960 p.		

8.2. Further reading

№	Name according to bibliographic requirements	Number of copies	
		at the department	in the library
1.	Malinovskaya S.L., Iydin D.I., Drygova O.V. Physics problem book. – Nizhny Novgorod: Publishing House of Privolzhsky Research Medical University, 2023.- 116 p.		
2.	Malinovskaya S.L., Iydin D.I., Drygova O.V. Physics and Biophysics problem book – Nizhny Novgorod: Publishing House of Privolzhsky Research Medical University, 2023.- 112 p.		
3.	Monich V.A. Physics and medical physics. – Nizhny Novgorod: Publishing House of Privolzhsky Research Medical University, 2018.- 116 p.		
4.	Monich V.A. Medical physics and biological problems. – Nizhny Novgorod: Publishing by Nizhny Novgorod State Medical Academy, 2009.- 68 p.		

8.3. Electronic educational resources for teaching academic subjects

8.3.1. Internal Electronic Library System of the University (IELSU)

№	Name of the electronic resource	Brief description (content)	Access conditions	Number of users
	Internal Electronic Library System (EBS)	The works of the academic staff of the Academy: textbooks and manuals, monographs, collections of scientific papers, scientific articles, dissertations, abstracts of dissertations, patents.	from any computer located on the Internet, using an individual login and password [Electronic resource] – Access mode: http://95.79.46.206/login.php	Not limited

8.3.2. Electronic educational resources acquired by the University

№	Name of the electronic resource	Brief description (content)	Access conditions	Number of users
	Electronic database "Student Consultant"	Educational literature + additional materials (audio, video, interactive materials, test tasks) for higher medical and pharmaceutical education. Publications are structured by specialties and disciplines in accordance with the current Federal State Educational Standards of Higher Education.	from any computer located on the Internet, using an individual login and password [Electronic resource] – Access mode: http://www.studmedlib.ru/	General PIM subscription
	Electronic library system "Bukap"	Educational and scientific medical literature of Russian publishers, including translations of foreign publications.	from any computer located on the Internet by login and password, from the computers of the academy. The publications for which a	General PIM subscription

			subscription is issued are available for reading. [Electronic resource] – Access mode: http://www.books-up.ru/	
	"Bibliopoisk"	Integrated "single window" search service for electronic catalogs, EBS and full-text databases. The results of a single search in the demo version include documents from domestic and foreign electronic libraries and databases available to the university as part of a subscription, as well as from open access databases.	PIM has access to the demo version of the Bibliopoisk search engine: http://bibliosearch.ru/pimu .	General PIM subscription
	Domestic electronic periodicals	Periodicals on medical subjects and on higher school issues	- from the academy's computers on the electronic library platform eLIBRARY.RU -magazines Media Sphere Publishing house - from library computers or provided by the library at the request of the user [Electronic resource] – Access mode: https://elibrary.ru/	
	International scientometric database "Web of Science Core Collection"	Web of Science covers materials on natural, technical, social, and humanitarian sciences; takes into account the mutual citation of publications developed and provided by Thomson Reuters; has built-in capabilities for searching, analyzing, and managing bibliographic information.	Access is free from PIM computers [Electronic resource] – Access to the resource at: http://apps.webofknowledge.com	Access is free from PIM computers

8.3.3 Open access resources

<i>Name of the electronic resource</i>	<i>Brief description (content)</i>	<i>Access conditions</i>
Federal Electronic Medical Library (FEMB)	It includes electronic analogues of printed publications and original electronic publications that have no analogues recorded on other media (dissertations, abstracts, books, magazines, etc.). [Electronic resource] – Access mode: http://nel.ru/	from any computer located on the Internet
Scientific Electronic Library eLIBRARY.RU	The largest Russian information portal in the field of science, technology, medicine and education, containing abstracts and full texts of scientific articles and publications. [Electronic resource] – Access mode: https://elibrary.ru/	from any computer located on the Internet.
Open Access Scientific Electronic Library CyberLeninka	Full texts of scientific articles with annotations published in scientific journals of Russia and neighboring countries. [Electronic resource] – Access mode: https://cyberleninka.ru/	from any computer located on the Internet
Russian State Library (RSL)	Abstracts for which there are copyright agreements with permission for their open publication [Electronic resource] – Access mode: http://www.rsl.ru/	from any computer located on the Internet
Legal reference system "Consultant Plus"	Federal and regional legislation, judicial practice, financial advice, comments on legislation, etc. [Electronic resource] – Access mode: http://www.consultant.ru/	from any computer located on the Internet
Official website of the Ministry of Health of the Russian Federation	National clinical guidelines. [Electronic resource] – Access mode: cr.rosminzdrav.ru - Clinical recommendations	from any computer located on the Internet
Official website of the Russian Respiratory Society	Modern materials and clinical recommendations for the diagnosis and treatment of respiratory diseases [Electronic resource] – Access mode: www.spulmo.ru – Russian Respiratory Society	from any computer located on the Internet
Official website of the Russian Scientific Society of Therapists	Modern materials and clinical recommendations for the diagnosis and treatment of diseases of internal organs [Electronic resource] – Access mode: www.rnmot.ru – Russian Scientific Society of Therapists	from any computer located on the Internet

9. Material and technical support for mastering an academic discipline

9.1. List of premises for classroom activities for the discipline

9.1.1. For lectures there are:

- BFC lecture halls (large and small halls);
- lecture hall of the Morphological Building;
- lecture hall of dormitory No. 3;
- lecture hall of building No. 9.

9.1.2. For practical training on the basis of building No. 2 there is:

- 4 specially equipped rooms (classrooms) for seminars and practical classes in the study of disciplines;
- 4 display classes.

9.2. List of equipment for classroom activities for the discipline:

9.2.1. Classrooms equipped with:

educational boards, educational furniture, teaching materials, PC, overhead projector, multimedia projector, laptop, Internet access.

9.2.2. A set of experimental equipment:

1. Laboratory scales SC 2020.
2. Analytical scales ALC-80d4.
3. Dosimeters.
4. The conductometer is portable.
5. PWT conductometer tester.
6. Lasers.
7. Luxmeters.
8. Multimeter 2000 E.
9. Biological microscopes.
10. Headphones.
11. Pulse oximeter.
12. pH meters.
13. IRF-464 refractometers (with backlight).
14. Installations for studying the phenomena of the photoelectric effect.
15. Photoelectrocolorimeters KFK-3.

16. Personal computers TCN.
17. BENQ monitors.
18. Laser printer.
19. Laptops.

20. Video lectures.
21. Videos for laboratory work.
22. Presentations of lectures.

**laboratory, instrumental equipment (specify which one), multimedia complex (laptop, projector, screen), TV, video camera, slide show, video recorder, PC, video and DVD players, monitors, sets of slides, tables/multimedia visual materials on various sections of the discipline, videos, whiteboards, etc.*

9.3. Set of licensed and freely distributed software, including domestic production

<i>№</i>	<i>Software</i>	<i>Number of licenses</i>	<i>Type of software</i>	<i>Manufacturer</i>	<i>Number in the unified register of Russian software</i>	<i>№ and contract date</i>
1.	Wtware	100	Thin Client Operating System	Kovalev Andrey Alexandrovich	1960	2471/05-18 of 28.05.2018
2.	My Office Is Standard. A corporate user license for educational organizations, with no expiration date, with the right to receive updates for 1 year.	220	Office Application	LLC " NEW CLOUD TECHNOLOGIES "	283	without limitation, with the right to receive updates for 1 year.
3.	LibreOffice		Office Application	The Document Foundation	Freely distributed software	
4.	Windows 10 Education	700	Operating systems	Microsoft	Subscription Azure Dev Tools for Teaching	
5.	Yandex.Browser		Browser	LLC «YANDEX»	3722	
6.	Subscription to MS Office Pro for 170 PCs for the FSBEI HE PRMU MOH Russia	170	Office Application	Microsoft		23618/HH100 30 LLC "Softline Trade " of 04.12.2020

10. List of changes to the working program (to be filled out by the template)

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation
(FSBEI HE "PRMU" of the Ministry of Health of Russia)

Department of
MEDICAL BIOPHYSICS

CHANGE REGISTRATION SHEET

working program for the academic discipline
PHYSICS

Field of study / specialty / scientific specialty: _____

(code, name)

Training profile: _____

(name) - for master's degree programs

Mode of study: _____

full-time/mixed attendance mode/extramural

Position	Number and name of the program section	Contents of the changes made	Effective date of the changes	Contributor's signature
1				

Approved at the department meeting

Protocol No. ____ of _____ 20__

Head of the Department

department name, academic title

signature

print name