



EDUCATIONAL TRAINING PROGRAM OF DISCIPLINE

“PHYSICS AND MATHEMATICS”

the main professional educational program of higher education - specialty program in the
specialty 31.05.01 General Medicine, approved, May , 24, 2023

Form of education	Full-time
The period of development	6
Department of	Public health, healthcare and social-economic sciences

When developing an educational training program, the discipline is based on:

1. Federal State Educational Standard of Higher Education on specialty 31.05.01 General Medicine, approved by the Ministry of Education and Science of the Russian Federation on February, 09, 2016 №95
2. Academic plan on specialty 31.05.01 General Medicine,
ЛД-16-04-18 ИИ
ЛД-16-05-19 ИИ
ЛД-16-06-20 ИИ,

approved by the Scientific Council of the Federal State Budgetary Educational Institution of Higher Education «North-Ossetia State Medical Academy» of the Ministry of Healthcare of the Russian Federation “24” May 2023, Protocol № 8.

The educational training program of the discipline was approved at a meeting of the central coordinating training and methodological council from “23” May 2023, Protocol №. 5

The educational training program of the discipline was approved by the Scientific Council of the State Medical University of the Federal State Budgetary Educational Institution of Higher Education «North-Ossetia State Medical Academy» of the Ministry of Healthcare of the Russian Federation from “24” May 2023, Protocol № 8.

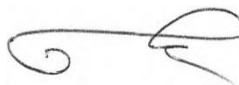
Developers:

Associate professor



R.Y. Gazdanova

Associate professor



N.I. Botsieva

Contents of the work program

1. the name of the discipline;
2. list of planned results of training in the discipline, correlated with the planned results of the development of the educational program;
3. indication of the place of the discipline in the structure of the educational program;
4. the amount of discipline in credit units, indicating the number of academic or astronomical hours allocated to the contact work of students with the teacher (by types of training sessions) and to the independent work of students;
5. content of the discipline, structured according to topics (sections) indicating the number of academic or astronomical hours assigned to them and types of training sessions;
6. list of educational and methodological support for independent work of students on discipline;
7. a fund of evaluation tools for conducting intermediate certification of trainees in discipline;
8. list of basic and additional educational literature necessary for mastering the discipline;
9. list of resources of the information and telecommunication network "Internet" (hereinafter referred to as the "Internet" network), necessary for mastering the discipline;
10. methodical instructions for students to learn the discipline;
11. list of information technologies used in the implementation of the educational process for discipline, including a list of software and information reference systems (if necessary);
12. a description of the material and technical base necessary for the implementation of the educational process for discipline;
13. conducting educational activities using e-learning and distance learning technologies.

2. List of planned learning outcomes for the discipline and the results of mastering the educational program

№	Room/ index complete the	Name of section disciplines	Results of development		
			Know	Be able to	Be master of
1	2	3	4	5	6
1.	GPC-7	Fundamentals of mathematical analysis, probability theory and mathematical of statistics.	Derivatives and differentials. Derivatives of complex functions. Integration rules. A random event. Definition of probability. Theorems for addition and multiplication of probabilities. Continuous and discrete random variables. Normal, exponential laws of distribution of continuous random variables. Distribution function. Probability density. Standard intervals.	Compute the derivatives and differentials of functions. Compute the indefinite and definite integrals by different methods. Calculate the mean values of functions, the area of plane figures, the work of variable force. Find solutions of differential equations with separable variables. Calculate the basic numerical characteristics of a random variable. Find the probability of getting the value of a normally distributed random variable in a given interval. Build polygons and histograms of frequencies and relative frequencies.	The main methods of differentiation and integration, the solution of differential equations with separating variables. A technique for calculating characteristics and estimating the distribution characteristics and measurement errors. Methods of statistical processing of the results of physical, chemical and biological research
2.	GC-5 GPC-7	Mechanics of liquids and gases. Biomechanics.	Mechanical waves. Equation of a plane wave.	Explain the dependence of the physiological	Methods for determining the viscosity of a

		Acoustics.	Parameters of oscillations and waves. Energy characteristics. Doppler effect. Sound. Kinds of sounds. Spectrum of sound. Wave resistance. Objective (physical) characteristics of sound. Subjective characteristics, their relationship to the objective. The Weber-Fechner law. Ultrasound, physical principles of application in medicine. Physical basis hemodynamics. Viscosity. Methods for determining the viscosity of a liquid. Stationary flow, laminar and turbulent flow. Newton's formula, Newtonian and non-Newtonian fluids. The Poiseuille formula. Reynolds number.	characteristics of sensation of sound from physical characteristics of the sound wave. To build an audiogram. Derive a formula for determining the rate of blood flow. Explain the method of obtaining ultrasound using the phenomenon of the inverse piezoelectric effect. Explain the method of ultrasound echolocation. Explain the physical nature of fluid viscosity, Newton's formula, fluid flow regimes, the Hagen-Poiseuille formula. Determine the viscosity of the liquid by the Stokes method. Solve situation problems.	liquid. Skills of work with an audiometer.
3.	GPC-7 PC-21	Electrical and magnetic properties of tissues and the surrounding environment	The main functions of biological membranes. A modern understanding of the structure of biological membranes. Physical state and phase transitions	Explain the mechanism passive and active transport through the membrane. Explain the mechanism of the potential of rest. Explain the mechanisms of generation	Method of determination impedance of tissues.

			<p>of lipids in membranes.</p> <p>Dynamics of membranes.</p> <p>Passive transfer of substances through membrane.</p> <p>Equations of Fick, Nernst-Planck.</p> <p>Active transport substances.</p> <p>The Ussing experience.</p> <p>Transmembrane potential.</p> <p>Potential of rest.</p> <p>Nernst's formula.</p> <p>The Goldman-Hodgkin-Katz equation.</p> <p>The Thomas equation.</p> <p>The potential of action, its properties.</p> <p>Ionic currents in the axon.</p> <p>Passive electrical properties tissues of the human body.</p> <p>The impedance (impedance) living tissues, frequency dependence.</p>	<p>dissemination of actions. Explain the reasons for the presence of capacitive resistance tissue.</p> <p>Investigate the dependence of the impedance on the frequency for equivalent electrical circuitry of tissue.</p>	
4.	GPC-7	Optics	<p>The phenomenon of complete internal reflection of light.</p> <p>Optical system of the eye.</p> <p>Fiber optics.</p> <p>Microscopy.</p> <p>Wave optics.</p> <p>Resolution optical devices.</p> <p>Optical activity.</p> <p>Interaction of light with matter.</p> <p>Scattering of light.</p>	<p>Identify with photoelectric colorimeter optical density and concentration of a substance in solution.</p> <p>Determine the linear dimensions micro-objects using microscope.</p> <p>Determine the refractive index of the glass plate.</p>	<p>By methods of colorimetry, polarimetry and refractometry.</p> <p>Skills of work with biological microscopes.</p>

			<p>Absorption of light.</p> <p>Optical density.</p> <p>Thermal radiation.</p> <p>Spectrum of blackbody radiation.</p> <p>Radiation of the Sun.</p> <p>Physical basis of thermal imaging</p>	<p>Explain (with illustrations):</p> <p>a) the law of Malus</p> <p>b) the phenomenon of rotation of the plane polarization</p> <p>c) polarization of light in a double refraction. Determine the specific rotation and concentration of optically active substances by means of a polarimeter.</p> <p>Solve situational challenges.</p>	
5.	GPC-7 PC-3	The quantum physics, ionizing radiation	<p>Optical spectra and molecules.</p> <p>Luminescence.</p> <p>Spectrofluorimetry</p> <p>Medical Effects visible and ultraviolet radiation. X-ray radiation.</p> <p>Interaction of α-, β- and γ-radiations with matter.</p> <p>Dosimetry of ionizing radiation.</p> <p>Lasers and their application in medicine.</p> <p>Interaction of X-rays with matter.</p>	<p>Apply the law of radioactive decay, the formula absorbed, exposure and equivalent doses in solving situational tasks.</p> <p>Using relations between dosimetric values calculate the types of radiation doses. Establish the relationship between system and non-systemic dosimetric units.</p> <p>Describe the mechanisms of action ionizing radiation on the human body.</p> <p>Explain the device and principle work ruby and helium-neon lasers.</p> <p>Solve Situational Challenges</p>	Methods for assessing the action physical factors on the body

1. The place of discipline in the structure of the educational program

The discipline "Physics, Mathematics" refers to the basic part of the program of Block 1 of the Federal State Educational Standard of Higher Education in specialty 31.05.01 General Medicine.

2. The scope of the academic discipline and types of academic work

Type of educational work		Total hours / credits units	Semesters
			I
Classroom activities (total)		80	80
Including:			
Lectures (L)		20	20
Practical training (PT)			
Seminars (C)			
Laboratory work (LW)		60	60
Independent work of the student (IWS), including		28	28
Type of intermediate appraisal	set-off (S)		(S)
	exam (E)		
TOTAL: Total labor intensity (units)		108	108
	3	3	3

3. Content of the discipline

п/п №	№ Semester	Name of the section disciplines	Types of educational activities, including independent work of students (in hours)					Forms of ongoing monitoring of academic performance (for the week of the semester)
			L	LW	PT	IWS	Bcero	
1	2	3	4	5	6	7	8	9
1.	I	Fundamentals of mathematical analysis, probability theory and mathematical statistics		24	-	5	29	C, T, ST
2.	I	Mechanics of liquids and gases. Biomechanics. Acoustics.	4	6	-	5	15	C, T, ST
3.	I	Electrical and magnetic properties of tissues and the environment.	4	6	-	5	15	C, T, ST
4.	I	Optics	4	12	-	5	21	C, T, ST
5.	I	The quantum physics, ionizing radiation	8	12	-	8	28	C, T, ST
		TOTAL:	20	60	-	28	108	

C-colloquium, T-test, ST- situational tasks

6. List of educational and methodological support for independent work of students in discipline

№	№ semester	Name of the teaching methodical development
1.	I	Gazdanova R.Y. Workbook for performing independent extracurricular work on the discipline "Physics, Mathematics". Vladikavkaz, NOSMA, 2020
2.	I	Gazdanova R.Y. A guide to practical and laboratory studies in the discipline "Physics, Mathematics". Vladikavkaz, NOSMA, 2020

7. The Fund of Evaluation Means for the Intermediate Certification of Students in Discipline

№/п	List of competences	№ semester	Indicator assessments	Evaluation Criteria	Scale of assessment	Name FES
1	2	3	4	5	6	7
1	GC-5 GPC-7 PC-21 PC-3	I	See standard for quality assessment of education, approved by order SBEE HPE NOSMA Ministry of Health of RF 10.07.2018г., №264/o	see the standard for assessing the quality of education , approved by order SBEE HPE NOSMA Ministry of Health of RF 10.07.2018г., №264/o	see the standard for assessing the quality of education , approved by order SBEE HPE NOSMA Ministry of Health of RF 10.07.2018г., №264/o	Tickets to offset; Test tasks.

8. The list of basic and additional educational literature necessary for mastering the discipline

п/п №	NAME	Author (S)	Year, place publications	Number of copies	
				in library	at the department
1	2	3	4	5	6
Basic literature					
1.	Медицинская и биологическая физика	Ремизов А.Н., Максина А.Г., Потапенко А.Я.	М., Дрофа, 2004. М., Дрофа, 2007. М., Дрофа, 2008. М., ГЭОТАР-Медиа, 2012. М., ГЭОТАР-Медиа, 2013	20 112 104	5 «Консультант студента» http://www.studmedlib.ru/book/I_SBN9785970424841.html .
Additional literature					
1.	Workbook for performing independent extracurricular work on the discipline "Physics, Mathematics".	Gazdanova R.Y.	Vladikavkaz, NOSMA , 2020		Electronic Option
2.	A guide to practical and laboratory studies in the discipline "Physics, Mathematics".	Gazdanova R.Y.	Vladikavkaz, NOSMA, 2020		Electronic Option

9. The list of resources of the information and telecommunication network "Internet", necessary for mastering the discipline

1. https://sanet.st/blogs/best4you12/physics_in_biology_and_medicine_fourth_edition.1294999.html
2. https://www.logobook.ru/prod_show.php?object_uid=12217138
3. https://www.logobook.ru/prod_show.php?object_uid=11073892
4. <file:///C:/Users/user/Downloads/367263-%D0%B8%D0%BD.pdf>

10. Methodical instructions for students to learn the discipline

The training consists of lecture classes (80 hours), including a lecture course and a laboratory workshop, and independent work (28 hours). The main academic time is allocated for laboratory work in physics and mathematics.

Practical exercises are conducted in the form of laboratory exercises with using laboratory equipment, visual aids. In the classroom computer testing, interview, graphic, situational tasks.

Active and interactive forms of conducting classes are used (video films, situational tasks, work in groups, independent extracurricular work).

The proportion of classes conducted in interactive forms is at least 20% of out-of-class studies.

Independent work of students implies the study of the educational literature, solution of situational learning tasks, computation and graphic works, model calculations, writing abstracts, creating presentations, protecting laboratory works, solving test tasks, performing extracurricular independent works.

Work with educational literature is considered as a kind of educational work on the discipline "Physics, Mathematics" and is performed within the hours allocated on its study. Each student is provided with access to the library funds of the Academy and to the resources of the information and telecommunication network "Internet".

For each section of the academic discipline designed methodical recommendations for students and guidelines for teachers. During the study of the academic discipline, students develop practical skills and skills under the supervision of the teacher. They independently conduct laboratory work, process the results of the study, plot the graphs, calculate the necessary parameters. The presented work is presented to the teacher for evaluation. The work of the student in groups creates a sense of teamwork, sociability, self-education, self-development and allows you to conduct research, both in the group, both individually and independently, to participate in discussions, build social relationships in the group. The training of students contributes to the development of their skills communication with people. Independent work contributes to the formation of accuracy, discipline.

The current control of the mastery of the subject is determined by an oral survey in the course of classes, solving typical, situational tasks and answers to test tasks, intermediate knowledge control is determined by testing and interviewing.

In the process of studying the discipline, students are abstract thinking, analysis, synthesis, readiness to use basic physical, mathematical and other natural science concepts and methods in solving professional problems.

11. List of information technologies used in the implementation of the educational process in discipline

Semester	Type of lessons L, PW, S,	Used educational technologies (active, interactive)	Number of hours	% of sessions in an interactive form	List of Software
I	L	Set of slides, videos for multimedia lecture, lecture-discussion	20	10	Microsoft Office PowerPoint InternetExplorer
I	LW	Work in small groups, solving situational problems, performing virtual LW, calculating and graphical works, model calculations, protecting laboratory work, testing	60	20	Microsoft Office Internet Explorer PowerPoint TTESTER
I	S	Execution of out-of-class independent work, tests for self-preparation in a computer class, writing abstracts, creating presentations. Questions and tasks for independent work	28	10	Microsoft Office Internet Explorer PowerPoint TTESTER

12. Description of the material and technical base necessary for the implementation of the educational process in discipline

Educational-laboratory base			
№	Type of premises	Quantity	Area, m ²
1	The office of the head of the department	1	17,2
2	Assistant's office	1	17,0
3	Assistant	1	17,0
4	Laboratory assistant	1	17,9
5	Study rooms	2	51,6
6	Educational laboratories	3	100,2
7	Computer classes	1	32,2
8	Utility room	3	51,5
total premises		13	
total area		270,2	
Laboratory equipment			
№	Name of equipment	Quantity	Technical condition
1	Apparatus Ultra high frequency therapy	2	Satisfactory
2	Apparatus low-frequency therapy «Amplipulse»	1	Satisfactory
3	Audiometer	1	Satisfactory

4	Analytical scales	1	Satisfactory
5	Electronic scales	1	Satisfactory
6	Dioptrimeter with a set of lenses.	1	Satisfactory
7	Sound generator	1	Satisfactory
8	Circular polarimeter	1	Satisfactory
9	Dual-beam oscilloscope	2	Satisfactory
10	Photoelectrocolorimeter	1	Satisfactory
11	Spectrophotometer	1	Satisfactory
12	Electrocardiograph «Axion»	2	Satisfactory
13	Two-tube spectroscopy	1	Satisfactory
14	Pulse oximeter	1	Satisfactory
15	Binocular microscope	3	Satisfactory
16	Monocular microscope	3	Satisfactory
Technical means of instruction, computer technology			
№	Name of equipment	quantity	Technical condition
1	Set: PC, monitor, uninterruptible power supply, keyboard, mouse	13	Satisfactory
2	Notebook	2	Satisfactory
3	Projector "Vivitek"	1	satisfactory
4	Canon Laser Printer	2	satisfactory
5	multifunctional device «Xerox»	1	Satisfactory
6	multifunctional device «Samsung»	1	Satisfactory
7	multifunctional device «Canon»	1	Satisfactory

13. Conducting educational activities using e-learning and distance learning technologies.

In the context of the introduction of restrictive measures (quarantine) associated with an unfavorable epidemiological situation, the threat of the spread of a new coronavirus infection and other force majeure events that do not allow full-time training, it is possible to study this discipline or part of it using e-learning and distance educational technologies.

Teaching the discipline in the above situations will be carried out through the development of an electronic course with access to video lectures and interactive course materials: presentations, articles, additional materials, tests and various tasks. When conducting training sessions, monitoring progress, as well as intermediate certification of students, platforms of the electronic information and educational environment of the academy and / or other e-learning systems recommended for use in the academy, such as Moodle, Zoom, Webinar, etc., can be used.

Lectures can be presented in the form of audio, video, "live lectures", etc. Conducting seminars and practical classes is possible on-line in both synchronous and asynchronous modes. Seminars can be conducted in the form of web conferences.