

Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Ястребов Олег Александрович
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"PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA"

MEDICAL INSTITUTE

COURSE PROGRAM

Discipline name - Physics
Recommended for the direction of training 31.05.01 - Medicine
Graduate qualification (degree) - Specialist

The development of the discipline is carried out within the framework of the implementation of the main professional educational program of higher education (EP HE):

Moscow – 2022

1. PURPOSE OF THE DISCIPLINE

The purpose of developing the discipline «Physics» is to obtain basic knowledge about the basic laws and concepts of physics, necessary for the formation of skills of physical thinking, natural scientific outlook and practical activities of a doctor. Learn the basic physical laws. To develop the ability to use physical abstractions and models when one's considering medical and biological problems and taking into account the conditions of applicability of the assumptions made. Form the skill to quantify the accuracy of scientific forecasting and experimental results.

2. REQUIREMENTS FOR THE RESULTS OF THE DISCIPLINE:

The process of studying the discipline "Physics" is aimed at the formation of the following competencies:

Table 2.1. List of competencies are formed by students during studying of the discipline (results):

Code	Competencies	Indicators of competence achievement (within the framework of this discipline)
UC-1	Being able to implement critical analysis of problem situations based on systems approach, develop an action strategy.	UC-1.2. Assessing in a critical way the reliability of information sources; working with contradictory information from different sources.
	Being able to use medical products prescribed by the medical procedure, as well as to carry out examinations of the patient for diagnosis.	GPC-4.2. Being able to evaluate the effectiveness and safety of the use of medical devices.

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE EP HE

The discipline "Physics" refers to the basic part of the block B1 of the EP HE.

Within the framework of the EP HE, students also master other disciplines and /or internships that contribute to achieving the planned results of mastering the discipline "Physics".

Table 3.1. The list of the components of the educational program that contribute to the achievement of the planned results of mastering the discipline

Code	Competencies	Previous disciplines /modules, internships	Subsequent disciplines/modules, internships
UC-1	Being able to implement critical analysis of problem situations based on systems approach, develop an action strategy.		Biochemistry Hygiene Public health and healthcare, healthcare economics Epidemiology Neurology, Medical Biochemistry Hygiene Public health and healthcare, healthcare economics Epidemiology Neurology, medical genetics, neurosurgery Hospital therapy Endocrinology

			Infectious diseases Phthisiology Medical Elementology Allergology Introduction to Nutritionology
GPC-4	Being able to use medical devices provided for by the procedure for providing medical care, as well as to conduct patient examinations in order to determine a diagnosis. GPC-4. Being able to use medical devices provided for by the procedure for medical care, and conduct patient examinations in order to determine a diagnosis		General surgery Neurology, medical genetics, neurosurgery Faculty therapy Endocrinology Obstetrics and gynecology Emergency Medical Manipulation Practice (Simulation Center)

4.The volume of disciplines and types of academic work

The total complexity of the discipline is 2 credits.

Type of educational work		TOTAL, ac.hr	Semesters			
			2			
Classroom activities (total)		51	51			
Including:		-	-	-	-	-
Lectures(L)		17	17			
Laboratory work (LW)		34	34			
Seminars (S)		-				
Independent work, ac. hr		21	21			
Checking (exam / test with assessment), ac.hr.						
Total complexity	ac.hours	72	72			
	credit units	2	2			

5.CONTENT OF THE DISCIPLINE

5.1The content of the discipline

No p/p	Name of discipline section	Content section	Type of educational work
1	Introductory lecture. Fundamentals of vector and	Methods of processing of measurement results. Direct and indirect measurements. Theory of errors. Types of errors: gross, systematic, random; absolute, relative. Rules for registration of laboratory work. The order of writing the abstract. Safety at work in the physical laboratory.	L, LW

	mathematical analysis	Basic concepts of mathematical and vector analysis. Derivatives and differentials. Rules for adding (subtracting) and multiplying vectors. Integration rules. Calculations of indefinite and definite integrals.	
2	Mechanics. Dynamics, mechanical oscillations	Introduction. Definitions (kinematics, dynamics, statics, trajectory, reference systems, equation of motion). Rectilinear motion. Circular motion. Inertia. Force of inertia. Dynamics of rotational motion. Moment of inertia. The moment of impulse and the law of its preservation. Gravitational interaction. Acceleration of gravity. Weightlessness. Harmonic vibrations. Gravitational interaction. Acceleration of gravity.	L, LW
		Work and energy. Potential field, the work of conservative forces, potential energy. Kinetic energy. The law of conservation of energy. Rotational motion of a rigid body. A moment of strength. The basic equation of the dynamics of rotational motion. The equation of motion of the angular momentum. The law of conservation of the angular momentum.	L, LW
3	The waves. Sound wave	Mechanical waves. The plane wave equation. Parameters of vibrations and waves. Energy characteristics. The Doppler effect and its use in medicine. Sound. Types of sounds. A complex tone and its acoustic spectrum. Wave resistance. Objective(physical)and subjective (biological) characteristics of sound. Infrasound. Ultrasound, the physical basis of application in medicine.	L, LW
4	Hydrostatic. Molecular Physics	The viscosity. Methods for determining the viscosity of liquids. Stationary flow, laminar and turbulent flows. Newton's formula, Newtonian and non-Newtonian liquids. The Poiseuille formula. The Reynolds number. Features of hemodynamics in the main, resistive, capillary and venous vessels of the circulatory model. Work and warmth. The first beginning of thermodynamics. Heat capacity. An adiabatic process (Poisson's formula). The basic equation of molecular kinetic theory. The heat and motion of molecules. The first principle of thermodynamics applied to the human body. The role of nutrition and respiration. Internal energy. Internal pressure and surface tension in the fluid. Diffusion. Osmosis. Wetting Capillary phenomena.	L, LW
5	Electricity and magnetism	Electric charges and their properties. Coulomb's law. The electrostatic field. Field strength. Power lines. Potential. Equipotential surfaces. The relationship between tension and potential. Conductors in an electrostatic field. Electrical capacity. Capacitors, their connection. The energy of the electric field. Current strength and current density. Electromotive force (EMF.). of the EMF source. Ohm's law for a homogeneous, inhomogeneous section of the circuit, for a closed circuit. The Kirchhoff rules. Ohm's laws and Kirchhoff's rules for direct current. Electric and magnetic fields, currents and electromagnetic fields. The total resistance (impedance) in electrical circuits. Ohm's law for alternating current and	L, LW

		voltage. Diathermy. UHF therapy. Microwave therapy. Physical foundations of rheography and its application in medicine.	
6	Optics	Geometric optics. The phenomenon of total internal reflection of light. Refractometry. Fiber optics. The eye is an optical system. Microscopy. Wave optics. Electromagnetic waves. The scale of electromagnetic waves. Energy characteristics of light fluxes: the flux of light radiation and the flux density (intensity). Diffraction grating. The resolution of optical devices and the eye. The polarization of light. Polarization microscopy. Polarimetry. The interaction of light with matter. Light scattering. Light absorption. The Booger-Lambert-Beer law.	L, LW
7	Electromagnetic radiation of the optical range	Thermal radiation. Characteristics and laws of thermal radiation. The spectrum of black body radiation. The radiation of the Sun. Application of Kirchhoff's law for measuring brightness temperature. . Calculation of the radiation temperature based on the Stefan-Boltzmann law. Lasers and their application.	L, LW
8	Atomic structure. EPR. NMR. Ionizing radiation.	Atomic structure. Nuclear force. Isotopes. Electronic paramagnetic resonance. Nuclear magnetic resonance. Principles of magnetic resonance imaging. Electron-positron tomography. Ultraviolet radiation and its application. X-ray radiation and its use in land management. Radioactive radiation. Detection and dosimetry of ionizing radiation	L, LW

7. Educational, methodical and informational support of the discipline: a)

Main literature

1. Samuel. J Ling, Jeff Sanny, William Moebis (2016), "**University Physics Vol 1**", Openstax, Rice University, .
2. Samuel. J Ling, Jeff Sanny, William Moebis (2016), "**University Physics Vol 2**", Openstax, Rice University, .
3. Radj Kumar, G.L. Mittal (1997), "Physics", Nageen Prakasham, Meerut.
4. Tom Duncan, Heather Kennett, (2014) "**Cambridge IGCSE Physics Third Edition**", Hodder Education, an Hachette UK Company.
5. Ahmed Mohammed (2008), "**Physics for Medical Students**", Wheatmark, 610 East Delano Street, suite 104, Tucson, Arizona 85705 U.S.A.
6. Karnilovich S. P., Yahya Shaar, "**The process of solving problems in physics**". Study guide for foreign students of RUDN and abroad. M.: RUDN, 2019. p.64

b) Additional Literature

1. V.M. Yavorsky, A.A. Pinsky. Fundamentals of Physics. -M .: Nauka, 2007.V..
2. N.I. Golovtsov, I.M. Kashirsky, A.P. Loginov, N.A. Kovalchukov, A.K. Nikitin, T.A. Ryzhov. Tasks in physics. –M.: Publishing house of RUDN University, 2008. -159с.2.
3. Konev S.V., Volotovskiy I.D. Photobiology // Minsk: BSU, 1974 - 285 p.
4. Nerpin S.V., Chudnovskiy A.F. Energy and mass transfer in the system “plant-soil-air” // L .: Hydrometeoizdat, 1975. - 358 s.
5. Vladimirov Yu.A. and others. Biophysics // M .: Medicine, 1991 - 427 с.

c) **software:** ОС MS Windows (XP и выше), MS Office 2010, Mentor, TUIS.

d) databases, reference and retrieval systems

1. «Soros Educational Journal» - <http://www.issep.rssi.ru>
2. Project “Ramler-science” - natural sciences - <http://www.nature.ru>
3. Electronic version of the journal "Science" - <http://www.sciencemag.org>

8. EVALUATION MATERIALS AND A POINT-RATING SYSTEM FOR ASSESSING THE LEVEL OF COMPETENCE FORMATION IN THE DISCIPLINE **Material and technical support of the discipline:**

Evaluation materials and a point-rating system* for assessing the level of competence formation (part of competencies) based on the results of mastering the discipline "Physics" are presented in the Appendix to this Work Program of the discipline.

* - GM and BRS are formed on the basis of the requirements of the relevant local regulatory act of the RUDN.

Developers:

Deputy Director of

the Institute of Physical Research and Technology

L.V. Konovaltseva

Director

of the Institute of Physical Research and Technology

O.T. Loza

First Deputy Director of MI for Academic Affairs

I.V. Radysch