Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University

Institute of Medicine

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Physics

course title

Recommended by the Didactic Council for the Education Field of:

31.05.01 General Medicine

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

General Medicine

higher education programme profile/specialisation title

2022-2023

1. COURSE GOAL(s)

The goal of the course "Physics" is to equip students with the 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 LEARNING OUTCOMES

Mastering the course (module) "Physics" is aimed at the development of the following competences /competences in part: GC-1, GPC-4

Table 2.1. List of competences that students acquire through the course study

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
GC-1	Being able to implement critical analysis of problem situations based on systems approach, develop an action strategy.	GC-1.2. Assessing in a critical way the reliability of information sources; working with contradictory information from different sources.
GPC-4	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.

2. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective* component of (B1) block of the higher educational programme curriculum.

* - Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	**Competence descriptor**	**Previous courses/modules***	**Subsequent courses/modules***

CC-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)

* To be filled in according to the competence matrix of the higher education programme.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course "Physics" is 2 credits (72 academic hours).

*Table 4.1. Types of academic activities during the periods of higher education programme mastering (**full-time training**)**

Type of academic activities		Total academic hours	Semesters/training modules			
			2			
Contact academic hours		51	51			
including:		-	-	-	-	-
Lectures (LC)		17	17			
Lab work (LW)		34	34			
Seminars (workshops/tutorials) (S)		-				
Self-studies		21	21			
Evaluation and assessment (exam/passing/failing grade)						
Course workload	academic hours	72	72			
	credits	2	2			

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Introductory lecture. Fundamentals of vector and mathematical analysis	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. 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.	LC, LW
Mechanics.	Introduction. Definitions (kinematics, dynamics, statics, trajectory, reference systems, equation of motion).	LC, LW

Dynamics, mechanical oscillations	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.	
	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.	LC, LW
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.	LC, LW
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.	LC, LW
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	LC, LW

	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 voltage. Diathermy. UHF therapy. Microwave therapy. Physical foundations of rheography and its application in medicine.	
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-Behr law.	LC, LW
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.	LC, LW
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	LC, LW

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture	A lecture hall for lecture-type classes, equipped with a set of specialised furniture; board (screen) and technical means of multimedia presentations.	
Lab work	A classroom for laboratory work, individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and machinery.	List of specialised laboratory equipment, machinery, stands, etc.
Seminar	A classroom for conducting seminars, group and individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and technical means for multimedia presentations.	List of specialised equipment, stands, visual posters, etc.
Computer Lab	A classroom for conducting classes, group and individual consultations, current and mid-term assessment, equipped with personal computers (in the amount of ____pcs), a board (screen) and technical means of multimedia presentations.	List of specialised software installed on computers for mastering the discipline
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Samuel. J Ling, Jeff Sanny, William Moebs (2016), "**University Physics Vol 1**", Openstax, Rice University, .

2. Samuel. J Ling, Jeff Sanny, William Moebs (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, Tucsun, Arisona 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

Additional readings:

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. -159c.2.
3. Konev S.V., Volotovsky I.D. Photobiology // Minsk: BSU, 1974 - 285 p.
4. Nerpin S.V., Chudnovsky 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 c.

c) **software:** OC 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

*Training toolkit for self- studies to master the course *:*

1. The set of lectures on the course "Physics"

* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION

The assessment toolkit and the grading system* to evaluate the competences formation level (GC-1, GPC-4) upon the course study completion are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

DEVELOPERS:

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position, department	signature	name and surname

Director of the Institute of Physical Research and Technology		O.T. Loza
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