

Approved by
Deputy Rector for Academic Affairs

_____ E.V. Konovalova

"15" June 2023, Record № 5

Physics, Mathematics

Syllabus

Department **Experimental Physics**

Curriculum s310501-ЛечДелоИн-23-1.pli.xml
Specialty 31.05.01 General Medicine

Qualification **General Practitioner**

Form of education **Full-time**

Total (in credits) **2**

Total academic hours 72

including:

Classes 48

Self-study 24

Control hours -

Control:

Credit, 2nd term

Course outline in terms

Academic year (Term)	2 (1.2)		Total	
	18			
Types of classes	Cur	Syl	Cur	Syl
Lectures	16	16	16	16
Laboratory	32	32	32	32
Classes total	48	48	48	48
Contact	48	48	48	48
Self-study	24	24	24	24
Total	72	72	72	72

The Syllabus is compiled by:

PhD in Physics and Mathematics, Associate Professor, Alekseev M.M. _____

The Syllabus

Physics, Mathematics

Developed in accordance with Federal State Educational Standard:

Federal State Educational Standard of higher education in the specialty 31.05.01 General medicine (Order of the Ministry of Education and Science of the Russian Federation on 12.08. 2020 № 988

Based on the Curriculum:

31.05.01 GENERAL MEDICINE

Specialization: General Medicine

Approved by the Academic Council of Surgut State University, “15” June 2023, Record № 5

The Syllabus was approved by the department

Experimental Physics

Head of Department, Doctor of Physics and Mathematics, Professor Elnikov A.V.

Chairman of Academic and Scientific Council, PhD in Medical Sciences (Medicine), Senior Lecturer Lopatskaya Zh.N.

1. COURSE OBJECTIVES	
1.1	<p>The aim of the course is to provide the basic knowledge and techniques used in physics and mathematics and which are needed to analyze physical problems in the research and development environment.</p> <p>The objectives of the course are to:</p> <ul style="list-style-type: none"> • Develop a conceptual understanding of the core concepts of physics. • Convince the student of the importance of differential and integral calculus in science and technology. • Give students hands-on experience with some of the experimental basis of modern physics. • Teach the student to use physical equipment to carry out various measurements. • Acquaint with the basic error analysis of experimental data.

2. COURSE OVERVIEW	
Course code (in curriculum)	B1.O.01.08
2.1	Assumed background:
	The course has minimal prerequisites, consisting of high school physics, algebra, plane geometry, and some trigonometry.
2.2	Post-requisite courses and practice:
	Physics, Mathematics is related to Chemistry, Biology, Life Safety course. This course is also essential for understanding X-Ray Diagnostics, Physiology and a number of other courses.

3. COMPETENCES UPON COMPLETION OF THE COURSE (MODULE)	
	GPC-4.1: Knows the physical principles of instrumental methods and equipment for diagnosing human diseases aimed at effective and differentiated application in professional activities

3.1	<p>By the end of the course students must know:</p> <ul style="list-style-type: none"> • The basic principles and concepts underlying a broad range of fundamental areas of physics. • The basic laws of physics, physical phenomena and patterns that underlie the processes occurring in nature. • The physical basis of the functioning of the measuring equipment. <p>be able to:</p> <ul style="list-style-type: none"> • Plan and execute an experiment or research, critically analyze the results and draw valid conclusions. • Demonstrate their knowledge of physics in a laboratory environment. • Evaluate the level of uncertainty in their results, understand the significance of error analysis and be able to compare these results with expected outcomes and theoretical predictions. <p>have skills of:</p> <ul style="list-style-type: none"> • Understanding of the importance of calculus in science and technology. • Using differential and integral calculus for solving mathematical problems.
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4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)							
Class Code	Topics /Class type	Term / Academic	Academic hours	Competences	Literature	Interactive	Notes
	Section 1. Vectors. Functions.						
1.1	Review of Vectors. Operations on vectors. Functions. Representations of functions. Limit of a function. Function of several variables. /Lec/	2	2	GPC-4.1	1.2	0	Points for discussion
1.2	Problem solving: Vectors, Functions and Function	2	4	GPC-4.1	1.2	0	Math test questions

	limits. /Lab/						
1.3	Homework assignment: Vectors, Functions and Function limits. /Self-study/	2	3	GPC-4.1	1.2	0	Math test questions
	Section 2. Derivative and Integral						
2.1	Derivative of the function. Applications of Derivatives. /Lec/	2	2	GPC-4.1	1.2	0	Math test questions
2.2	Problem solving: Derivative of a function. /Lab/	2	4	GPC-4.1	1.2	0	Math test questions
2.3	Homework assignment: Derivative of a function. /Self-study/	2	3	GPC-4.1	1.2	0	Math test questions
2.4	Integral of a function. Applications of Integrals. /Lec/	2	2	GPC-4.1	1.2	0	Math test questions
2.5	Problem solving: Integral of a function. /Lab/	2	4	GPC-4.1	1.2	0	Math test questions
2.6	Homework assignment: Derivative and Integral of a function. /Self-study/	2	3	GPC-4.1	1.2	0	Math test questions
	Section 3. Mechanics						
3.1	Motion in two and three dimensions. Force and motion. Oscillations. Sound waves. The Doppler effect. /Lec/	2	2	GPC-4.1	1.1 2.1 2.2	0	Points for discussion
3.2	Measurement of linear dimensions and volumes of bodies of regular geometric shape. /Lab/	2	4	GPC-4.1	3.1	0	Lab reports questions
3.3	Laboratory reports. /Self-study/	2	3	GPC-4.1	3.1	0	Lab reports
	Section 4. Thermodynamics and molecular physics						
4.1	Temperature, heat, and the first law of the thermodynamics. Viscosity. /Lec/	2	2	GPC-4.1	1.1 2.1 2.3	0	Points for discussion
4.2	Measurement of viscosity of liquids. /Lab/	2	4	GPC-4.1	3.2	0	Report questions
4.3	Laboratory reports. /Self-study/	2	3	GPC-4.1	3.2	0	Lab reports
	Section 5. Electricity and magnetism						
5.1	Electric charge. Electric fields. Electric potential. Magnetic fields. /Lec/	2	2	GPC-4.1	1.1 2.1 2.4	0	Points for discussion
5.2	Ohm's Law. /Lab/	2	4	GPC-4.1	3.3	0	Report questions
5.3	Laboratory reports. /Self-study/	2	3	GPC-4.1	3.3	0	Lab reports
	Section 6. Optics						
6.1	Electromagnetic waves. Interference. Diffraction. Polarization. /Lec/	2	2	GPC-4.1	1.1 2.1	0	Points for discussion

6.2	Polarization of light. /Lab/	2	4	GPC-4.1	3.4	0	Report questions
6.3	Optically active solutions. /Lab/	2	4	GPC-4.1	3.4	0	Report questions
6.4	Laboratory reports. /Self-study/	2	3	GPC-4.1	3.4	0	Lab reports
Section 7. Nuclear physics							
7.1	Nuclear physics. Radioactive decay. Measuring radiation dosage. /Lec/	2	2	GPC-4.1	1.1 2.1 2.5	0	Points for discussion
7.2	Medical use of X Rays. Magnetic moments in an external magnetic field. Magnetic resonance imaging. /Self-study/	2	3	GPC-4.1	1.1 2.1 2.5	0	Points for discussion
	Credit	2	-	GPC-4.1	1.1 1.2 2.1	0	Math and Physics test

5. ASSESSMENT TOOLS

5.1. Assessment tools for midterm assessment

Presented by a single document

5.2. Assessment tools for diagnostic testing

Presented by a single document

6. COURSE (MODULE) RESOURCES

6.1. Recommended Literature

6.1.1. Core

	Authors	Title	Publish., year	Quantity
1.1	David Halliday, Robert Resnick, Jearl Walker	Fundamentals of physics, 10 th Edition International Student Version	Wiley, 2014	31
1.2	Michael Spivak	Calculus	Cambridge UP, 2006	31

6.1.2. Supplementary

	Authors	Title	Publish., year	Quantity
2.1	Trofimova T.I.	Course on Physics: recommended by the Ministry of Education of the Russian Federation as a teaching aid for engineering and technical specialties in higher educational institutions	Moscow: Publishing House "Academy", 2016	30
2.2	Irodov I.Y.	Mechanics. Basic laws: a textbook for university students	Moscow: Fizmatlit, 2001	8
2.3	Irodov I.Y.	Macrosystem physics. Basic laws	Moscow: Laboratory of knowledge, 2015	1
2.4	Irodov I.Y.	Electromagnetism: Basic laws	Moscow: Laboratory of basic knowledge, 2002	7
2.5	Irodov I.Y.	The quantum physics. Basic laws	Moscow: Binom. Laboratory of knowledge, 2007	20

6.1.3. Methodical development

3.1	Zavodovskiy A.G., Gurtovskaya R.N., Sysoev S.M., Konovalova E.V.	Laboratory works on Mechanics	Surgut: SurGU Publishing Center, 2010	1
3.2	Zavodovskiy A.G., Gurtovskaya R.N., Konovalova E.V., Manina E.A.	Molecular Physics and Thermodynamics: Laboratory works	Surgut: SurGU Publishing Center, 2010	259

3.3	Sysoev S.M., Manina E.A., Nikonova N.O.	Laboratory works on Electricity and Magnetism: Guidelines for Laboratory works in General Physics.	Surgut: SurGU Publishing Center, 2004	17
3.4	Sysoev S.M., Zavodovskiy A.G., Elnikov A.V., Gurtovskaya R.N.	Optical measurements	Surgut: SurGU Publishing Center, 2016	64
3.5	Gurtovskaya R.N., Panina T.A., Nenakhova N.A., Zavodovskiy A.G.	Laboratory works on Quantum Physics	Surgut: SurGU Publishing Center, 2016	65

6.2. Internet resources

E1	http://www.scholarpedia.org/article/Encyclopedia:Physics
E2	https://www.britannica.com/science/physics-science
E3	http://physics.usask.ca/~hirose/ep225/ep225fp.htm
E4	http://www.physicscentral.com/

6.3.1 Software

6.3.1.1	Open source office suite LibreOffice
6.3.1.2	Open source development environment for scientific computing Octave
6.3.1.3	Computer algebra system Maxima

6.3.2 Information Referral systems

6.3.2.1	https://iwant2study.org/ospsg/index.php/interactive-resources/physics
6.3.2.2	http://guides.ou.edu/oer/physics

7. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE (MODULE)

7.1	Classrooms for practical classes, laboratory lessons, group and individual consultations, monitoring and intermediate certification are equipped with: typical classroom furniture, technical teaching aids, employees for the presentation of educational information.
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