Khanty-Mansiysk Autonomous Okrug-Ugra
"Surgut State University"

Approved by Deputy Rector for Academic Affairs

_____E.V.

Konovalova 11 June 2025 г.,

Record No 5

Physics, Mathematics

Syllabus

Department **Experimental Physics**

Curriculum s310501-ЛечДелоИн-25-1.plx
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:

Credit, 1st term

Course outline in terms

Academic year (Term)	1 (1.1)		Total	
Weeks	15 3/6			
Types of classes	Cur	Syl	Cyr	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, 11 June 2025 г., Record No 5

The Syllabus was approved by the department
Experimental Physics

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

1. COURSE OBJECTIVES	
1.1	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.
1.2	The objectives of the course are to:
1.3	- Develop a conceptual understanding of the core concepts of physics.
1.4	- Convince the student of the importance of differential and integral calculus in science and technology.
1.5	- Give students hands-on experience with some of the experimental basis of modern physics.
1.6	- Teach the student to use physical equipment to carry out various measurements.
1.7	- Acquaint with the basic error analysis of experimental data.

2. COURSE OVERVIEW	
Course code (in curriculum)	Б1.О.01
2.1	**Assumed background:**
2.1.1	The course has minimal prerequisites, consisting of high school physics, algebra, plane geometry, and some trigonometry.
2.2	**Post-requisite courses and practice:**
2.2.1	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 Demonstrates knowledge of the basics of instrumental methods of diagnostics, understanding of physical principles of equipment operation for practical application - diagnostics and differential diagnostics of human diseases and their application in professional activity

By the end of the course students must

3.1	**know:**
3.1.1	The basic principles and concepts underlying a broad range of fundamental areas of physics.
3.1.2	The basic laws of physics, physical phenomena and patterns that underlie the processes occurring in nature.
3.1.3	The physical basis of the functioning of the measuring equipment.
3.1.4	
3.2	**be able to:**
3.2.1	Plan and execute an experiment or research, critically analyze the results and draw valid conclusions.
3.2.2	Demonstrate their knowledge of physics in a laboratory environment.
3.2.3	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.

4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)

Class Code	Topics /Class type	Term / Academic	Academic hours	Competences	Literature	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/	1	2	GPC-4.1	1.2 E3	
1.2	Problem solving: Vectors, Functions and Function limits /Lab/	1	4	GPC-4.1	1.2 2.5 2.6 3.5 E3	
1.3	Homework assignment: Vectors, Functions and Function limits	1	3	GPC-4.1	1.2 E3	
	Section 2. Derivative of a function					
2.1	Derivative of the function. Applications of Derivatives /Lec/	1	2	GPC-4.1	1.2 E3	

2.2	Problem solving: Derivative of a function /Lab/	1	4	GPC-4.1	1.2 2.5 2.6 3.5 E3	
2.3	Homework assignment: Derivative of a function /Self-study/	1	3	GPC-4.1	1.2 E3	
	Section 3. Integral of a function					
3.1	Integral of a function. Applications of Integrals /Lec/	1	2	GPC-4.1	1.2 E3	
3.2	Problem solving: Integral of a function /Lab/	1	4	GPC-4.1	1.2 2.5 2.6 3.5 E3	
3.3	Homework assignment: Derivative and Integral of a function /Self-study/	1	3	GPC-4.1	1.2 E3	
	Section 4. Mechanics					
4.1	Motion in two and three dimensions. Force and motion /Lec/	1	2	GPC-4.1	1.1 1.2 2.1 2.2 2.4 E1 E2	
4.2	Measurement of linear dimensions and volumes of bodies of regular geometric shape /Lab/	1	4	GPC-4.1	1.1 1.2 2.1 2.2 2.4 3.2 E1 E2	
4.3	Measurement of free fall acceleration using simple gravity pendulum /Lab/	1	4	GPC-4.1	1.1 1.2 2.1 2.2 2.4 3.2 E1 E2	
4.4	Laboratory reports /Self-study/	1	3	GPC-4.1	1.1 1.2 2.1 2.2 2.4 E1 E2	
	Section 5. Thermodynamics and molecular physics					
5.1	Temperature, heat, and the first law of the thermodynamics /Lec/	1	2	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	
5.2	Measurement of viscosity of liquids /Lab/	1	4	GPC-4.1	1.1 1.2 2.2 2.4 3.1 E1 E2	
5.3	Laboratory reports /Self-study/	1	3	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	
	Section 6. Electricity and magnetism					
6.1	Electric charge. Electric fields. Electric potential. Magnetic fields /Lec/	1	2	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	
6.2	Ohm's Law /Lab/	1	4	GPC-4.1	1.1 1.2 2.2 2.4 3.4 E1 E2	
6.3	Laboratory reports /Self-study/	1	3	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	
	Section 7. Optics					
7.1	Electromagnetic waves. Interference. Diffraction. Polarization /Lec/	1	2	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	

7.2	Polarization of light /Lab/	1	4	GPC-4.1	1.1 1.2 2.2 2.4 3.3 E1 E2	
7.3	Laboratory reports /Self-study/	1	3	GPC-4.1	1.1 1.2 2.2 2.4 E1 E2	
	Section 8. Nuclear physics					
8.1	Nuclear physics. Radioactive decay. Measuring radiation dosage /Lec/	1	2	GPC-4.1	1.1 1.2 2.2 2.3 2.4 E1 E2	
8.2	Medical use of X Rays. Magnetic moments in an external magnetic field. Magnetic resonance imaging /Self-study/	1	3	GPC-4.1	1.1 1.2 2.2 2.3 2.4 E1 E2	
	Section 9.					
9.1	/Test/	1	0	GPC-4.1	1.2 1.1 2.2 2.4 E1 E2	
9.2	/Credit /	1	0	GPC-4.1	1.2 1.1 2.2 2.4 E1 E2	

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	Walker J., Halliday D., Resnick R.	Principles of Physics: International Students Version	Hoboken: Wiley, cop. 2014	31
1.2	Spivak M.	Calculus	Cambridge: Cambridge University Press, 2017	31

6.1.2. Supplementary

	Authors	Title	Publish., year	Quantity
2.1	Mustafaev A. S., Filyasova Yu. A.	A General Course of Physics. Mechanics: Textbook	St. Petersburg: St. Petersburg Mining University, 2017, electronic resource	1

	Authors	Title	Publish., year	Quantity
2.2	Remizov A.N.	Medical and biological physics: textbook	Moscow: GEOTAR-Media, 2021, electronic resource	2
2.3	Astapov I. I., Barbashina N. S., Dmitrieva A. N., Zadeba E. A., Khokhlov S. S., Yashin I. I.	Problem book for the course Nuclear Physics: educational edition	Moscow: National Research Nuclear University MEPhI, 2020, electronic resource	1
2.4	Khrunina, M. A.	Basics of Physics II (Basics of Physics II): study guide	Novosibirsk: Novosibirsk State University, 2022, electronic resource	1
2.5	Abramyan M.E.	Lectures on differential calculus of functions of one variable: textbook	Moscow: SFU, 2020, https://www.student electronic resource	2
2.6	Abramyan M.E.	Lectures on integral calculus of functions of one variable and series theory	Rostov-on-Don, Taganrog: Southern Federal University Publishing House, 2021, electronic resource	1
6.1.3. Methodical development				
	Authors	Title	Publish., year	Quantity
3.1	Zavodovsky A. G., Gurtovskaya R. N., Konovalova E. V., Manina E. A.	Molecular physics and thermodynamics: laboratory workshop	Surgut: Surgut Publishing Center, 2010	259
3.2	Zavodovsky A. G., Konovalova E. V., Sysoev S. M.	Mechanics: educational manual	Surgut: Surgut Publishing Center, 2021	30
3.3	Alekseev M. M., Jalilov M. A., Zavodovsky A. G., Loginov V. A.	Optics: laboratory workshop	Surgut: Publishing center of Surgut State University, 2023, electronic resource	1
3.4	Manina E. A.	Laboratory workshop on electricity and magnetism: educational and methodological manual	Surgut: Publishing center of Surgut State University, electronic resource	1
3.5	Vegera J. G.	Introduction to calculus: workshop	Moscow: RTU MIREA, 2023, electronic resource	1
6.2. Internet resources				
E1	Physics - OpenStax https://openstax.org/details/books/physics			

E2	PhET: Free online physics, chemistry, biology, earth science and math simulations https://phet.colorado.edu/
E3	Calculus - OpenStax https://openstax.org/details/books/calculus-volume-1
6.3.1 Software	
6.3.1.1	A suite of software applications used for word processing and creating spreadsheets Microsoft Office
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
6.3.2.3	http://www.garant.ru
6.3.2.4	http://www.consultant.ru/

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.