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

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

COURSE SYLLABUS

MATHEMATICS
(discipline/module name)

Recommended by the Didactic Council for the Education Field of:

31.05.03 DENTISTRY
field of studies / speciality code and title

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

DENTISTRY
higher education programme profile/specialisation title

2026

1. COURSE GOAL(s)

The course "Mathematics" is included in the specialist program "Dentistry" in the field of study 31.05.03 "Dentistry" and is studied in the 1st semester of the 1st year. The discipline is implemented by the Academician S.M. Nikolsky Mathematical Institute. The discipline consists of 4 sections and 11 topics and is aimed at studying basic information on the specifics of mathematical methods based on modern literature to acquire the skills necessary for solving practical problems.

The goal of mastering the course is to cultivate the necessary mathematical culture, acquire skills in using mathematics as a method for solving modern scientific problems in mathematical biology, biophysics, and chemistry; develop logical thinking, the ability to operate with abstract objects.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the course (module) “Mathematics” is aimed at the development of the following competences: GC-1, GC-6, GPC-8.

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	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy	GC-1.1. Analyzes the problem situation as a system, identifying its components and relationships between them GC-1.2. Identifies gaps in information needed to solve a problem situation and designs processes to address them GC-1.3. Critically evaluates the reliability of information sources, works with conflicting information from different sources GC-1.4. Develops and substantively argues a strategy for solving a problem situation based on a systematic and interdisciplinary approach
GC-6	Able to identify and implement the priorities of their own activities and ways to improve them based on self-assessment and lifelong learning	GC-6.1. Evaluates his resources and their limits (personal, situational, temporary), uses them optimally for the successful completion of the assigned task
GPC-8	Able to use the basic physico-chemical, mathematical and natural science concepts and methods in solving professional problems	GPC-8.1. Applies basic fundamental physical and chemical knowledge to solve professional problems GPC-8.2. Applies applied natural science knowledge to solve professional problems GPC-8.3. Applies fundamental mathematical knowledge to solve professional problems

3.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*
GC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy	-	Physics, Pediatric dentistry, Obstetrics, Gnathology and Temporo-Mandibular Joint's Functional Diagnostics, Prosthodontics (Simple Prosthetics), Prosthodontics of Edentulous Patient, Prosthodontics (Complex Prosthetics), Pediatric Maxillofacial Dentistry, Maxillofacial Prosthodontics, State Exam
GC-6	Able to identify and implement the priorities of their own activities and ways to improve them based on self-assessment and lifelong learning	-	Chemistry, State Exam
GPC-8	Able to use the basic physico-chemical, mathematical and natural science concepts and methods in solving professional problems	-	Physics, Obstetrics, State Exam

* 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 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**
			1
Contact academic hours	*34*		*34*
Lectures (LC)	17		17
Lab work (LW)	0		0
Seminars (workshops/tutorials) (S)	17		17
Self-studies	*20*		*20*
Evaluation and assessment (exam/passing/failing grade)	*18*		*18*
Course workload	academic hours	***72***	*72*
	credits	***2***	*2*

3. CONTENT OF THE DISCIPLINE

Table 5.1. Content of the discipline (module) by type of academic work

Course module title	Course module contents (topics)	Academic activities types
Section 1 Review of basic information from the high school algebra course	1.1 What kinds of numbers are there? – Number line, absolute value – Transformations of numerical fractions – Numerical, literal, algebraic expressions – Transformations of algebraic expressions Mathematics as a method for studying biological systems. Connection of scientific disciplines. Examples of formulating and solving biological problems using mathematical methods. Physico-chemical processes, their formalization. Multiphysics problems. Quantitative and qualitative models, reduction, the idea of qualitative analysis of a mathematical model. Ideas of linearization methods and successive approximations.	S
	1.2 Percentages, mass concentration – Proportion – Logarithm. Review of basic information from the high school algebra course. What kinds of numbers are there? – Number line, absolute value – Transformations of numerical fractions – Numerical, literal, algebraic expressions – Transformations of algebraic expressions – Percentages, mass concentration – Proportion – Logarithm.	S
Section 2 Linear Algebra	2.1 Cartesian coordinate system. Solving a system of two linear equations (SLE) analytically and graphically Cartesian coordinate system. Solving a system of two linear equations (SLE) analytically and graphically. Number line – Cartesian coordinate system – Equality – Equation – Graphical and analytical solution of equations – Solving a linear equation with 1 unknown – Solving a linear equation with 2 unknowns – Solving a system of 2 linear equations with 2 unknowns	LC, S
	2.2 Vectors and matrices.. Solving SLE using the Gauss-Jordan method Vectors and matrices. Solving SLE using the Gauss-Jordan method. Scalar and vector – Dot product of vectors – Orthogonality – Vector length – Angle between vectors – Method of adding equations – Matrix notation of СЛУ, Gauss- Jordan method with integer coefficients for the case of definite systems.	LC, S
	2.3 Linear dependence of equations. General and particular solution of SLE Linear dependence of equations. General and particular solution of SLE. Linear dependence of vectors, equations (algebraic and geometric interpretations). General and particular solution of a consistent indefinite SLE. Inconsistent systems.	LC, S

	2.4 Operations on matrices Multiplication of vectors and matrices. Transformation of a vector as its multiplication by a matrix on the left – algebraically and geometrically (on the plane). Matrix product.	LC, S
	2.5 Определитель и собственные значения матрицы. Determinant and eigenvalues of a 2x2 matrix. Cramer's rule. Homogeneous systems. Eigenvalues and eigenvectors of a 2x2 matrix, characteristic equation of the matrix. LEC, SC Section 3 Differential Calculus	LC, S
Section 3 Дифференциальное исчисление.	3.1 Functions and their graphs. LEC, SC 3.2. LEC, SC 3.3 LEC, SC 3.. LEC, SC Section 4 Final session. Functions and their graphs. Numbers, parameters, variables – Cartesian coordinate system – Function, ways of defining it, domain of definition – Graph of a function, its advantages – Functions and their graphs in physiology – Elementary functions and their graphs – Transformation of graphs – Properties of functions (positivity, negativity, parity, oddness, monotonicity, extrema, graph inflections, periodicity) – Sketching a graph based on features (without a table) – Graphs of functions with parameters – Asymptotes – Limit of a sequence – Limit of a function (limit of a continuous function at a point and at infinity; limit at a discontinuity point) – Finding the limit of a rational function at infinity – Theorems on limits – Analyzing a function graph using limits – Plan for analyzing functional dependence.	LC, S
	3.2 Fundamentals of differential calculus. Analysis of graphs using derivatives. Fundamentals of differential calculus. Analysis of graphs using derivatives.. Speed of mechanical motion, rate of change of physiological variables – Derivative – Tangent and secant – Slope of the tangent – Linearization of a function, differential – Calculation of simplest derivatives – Table of derivatives – Rules of differentiation – Analysis of function graphs using 1st and 2nd derivatives	LC, S
	3.3 Fundamentals of integral calculus Fundamentals of integral calculus. Antiderivative and indefinite integral – Geometric meaning of the antiderivative – Table of indefinite integrals – Rules of integration – Definite integral, Newton-Leibniz formula	LC, S
	3.4 Differential equations of one variable Differential equations (DEs) with separable variables DE of one variable – Reason for using DE – Examples from hysics, chemistry, biology – General and particular solutions of DE – Cauchy problem	LC, S

Section 4 Final session	Control	

*- to be filled in only for **full** -time training: *LC - lectures; LW - lab work; S - seminars.*

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	Classroom for lecture-type classes, equipped with a set of specialized furniture; a board (screen) and multimedia presentation technical means.	
Seminar	Classroom for seminar-type classes, group and individual consultations, ongoing monitoring and intermediate assessment, equipped with a set of specialized furniture and multimedia presentation technical means.	
Self-studies	Classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialized 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. CalculusVolume1 (2016) OpenStax, RiceUniversity.

2. Lipschutz (1991) Theory and Problems of Linear Algebra

Additional literature:

1. Introduction to Linear Algebra, Second Edition, Serge Lang, Springer

Resources of the Internet Information and Telecommunications Network:

1. RUDN University Electronic Library System and third-party electronic library systems to which university students have access

based on concluded agreements

- RUDN University Electronic Library System – RUDN University Electronic Library System https://mega.rudn.ru/MegaPro/Web

- "University Library Online" Electronic Library System http://www.biblioclub.ru

- "Urait" Electronic Library System http://www.biblio-online.ru

- "Student Consultant" Electronic Library System www.studentlibrary.ru

- "Znanium" Electronic Library System https://znanium.ru/

2. Databases and search engines

· Sage https://journals.sagepub.com/
· Springer Nature Link https://link.springer.com/
· Wiley Journal Database https://onlinelibrary.wiley.com/
· Scientometric database Lens.org https://www.lens.org

Educational and methodological materials for independent work of students during mastery of the discipline/module*:

1. Lecture course on the discipline "Mathematics".

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the discipline page in the Telecommunication Educational Information System **TUIS**!

DEVELOPERS:

Senior lecturer,

Mathematical institute		**H.N. Shamel**
position, department	signature	name and surname

HEAD OF EDUCATIONAL DEPARTMENT:

of Mathematical institute		**A.B. Muravnik**
name of department	signature	name and surname

HEAD
OF HIGHER EDUCATION PROGRAMME:

Deputy director for academic affairs		**S.N. Razumova**
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