Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA

Agrarian and Technological Institute

WORKING COURSE SYLLABUS

Maths

Recommended by the Methodological Council for the Education Field:

36.05.01 Veterinary medicine

2022 г.

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The aim of mastering the discipline "**Maths**" is to familiarize students with the fundamental concepts of the course "Mathematics", which includes sections: elements of linear algebra, elements of analytical geometry, mathematical analysis.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

The development of the discipline "**Maths**" is aimed at creating the following competencies (parts of competencies) for students:

Table 2.1. List of competencies formed by students during the development of the discipline (results of the development of the discipline)

Code	Competence	Indicators of competence accomplishment (within the discipline)
UK-1	The ability to carry out a critical analysis of problem situations based on a systematic approach, to develop a strategy of action.	UK-1.1 Analyzes the task, highlighting its basic components;
		UK-1.2 Defines and ranks the information required to solve the task;
		UK -1.3 Searches for information to solve the task by various types of queries;
		UK-1.4 Offers solutions to the problem, analyzes the possible consequences of their use;
		UK -1.5 Analyzes the ways of solving problems of a philosophical, moral and personal nature based on the use of basic philosophical ideas and categories in their historical development and socio-cultural
UK -2	The ability to manage a project at all stages of its life cycle.	UK-2.1 Formulates a problem, the solution of which is directly related to the achievement of the project goal;
		UK -2.2 Defines the links between the tasks set and the expected results of their solution;
		UK -2.3 Within the framework of the tasks set, determines the available resources and restrictions, the current legal norms;
		UK -2.4 Analyzes the schedule for the implementation of the project as a whole and chooses the best way to solve the tasks, based on the current legal norms and available resources and limitations;
		UK -2.5 Monitors the progress of the project, adjusts the schedule in accordance with the results of the control.

UK -3	The ability to organize and manage the work of the team, developing a team strategy to achieve the goal.	UK-3.1 Defines his role in the team based on the strategy of cooperation to achieve the goal;
		UK-3.2 Formulates and takes into account in its activities the peculiarities of the behavior of groups of people, identified depending on the goal;
		UK-3.3 Analyzes the possible consequences of personal actions and plans his actions to achieve the desired result;
		UK-3.4 Exchanges information, knowledge and experience with team members;
		UK -3.5 Argues his point of view regarding the use of the ideas of other team members to achieve the goal;
		UK -3.6 Participates in team work on the execution of assignments.
UK -6	The ability to determine and implement the priorities of one's own activity and ways to improve it based on self-assessment and lifelong education.	UK-6.1 Controls the amount of time spent on specific activities;
		UK-6.2 Develops tools and methods of time management when performing specific tasks, projects, goals;
		UK -6.3 Analyzes its resources and their limits (personal, situational, temporary, etc.), for the successful completion of the task;
		UK -6.4 Finds and uses sources of additional information to increase the level of general and professional knowledge;
		UK -6.5 Analyzes the main opportunities and tools of continuing education in relation to their own interests and needs, taking into account the conditions, means, personal capabilities, stages of career growth, time prospects for the development of activities and the requirements of the labor market;
		UK -6.6 Defines the tasks of self-development, goals and priorities of professional growth;
		UK -6.7 Distributes tasks into long-, medium- and short-term ones with justification of relevance and analysis of resources for their implementation.
UK-10		UK -10.1 Understands the basic principles of the functioning of the economy and

	The ability to make informed economic decisions in various areas of life	economic development, the goals of the form of state participation in the economy;
		UK -10.2 Applies methods of personal economic and financial planning to achieve current and long-term financial goals;
		UK -10.3 Uses financial instruments to manage personal finances (personal budget), controls its own economic and financial risks.
UK -12	The ability to search for the necessary sources of information and data, to perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; to evaluate information, its reliability, build logical conclusions based on incoming information and data	UK -12.1 Searches for the necessary sources of information and data, perceives, analyzes, remembers and transmits information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems
		UK-12.2 Evaluates information, its reliability, builds logical conclusions based on incoming information and data
GPC -4	The ability to use methods of solving problems using modern equipment in the development of new technologies in professional activity and to use modern professional methodology for conducting experimental research and interpreting their results.	GPC-4.1 Possesses the conceptual and methodological apparatus of basic natural sciences at a level sufficient for full-fledged professional activity at the modern level.
		GPC-4.2 He knows the methods of solving problems using modern equipment.
		GPC-4.3 He is ready to use modern methodology in the development and conduct of experimental research.
		GPC-4.4 Uses modern professional methodology in interpreting research results.
GPC -7	He is able to understand the principles of modern information technologies and use them to solve the tasks of professional activity.	GPC-7.1 Understands the principles of modern computer technology and telecommunications and is able to use them to solve professional problems;
		GPC-7.2 Uses modern special software and specialized databases to solve professional tasks and perform official duties;
		GPC-7.3 Has the skills to work on modern medical diagnostic and therapeutic equipment with software;

		GPC-7.4 Uses specialized databases to solve professional problems in the field of diagnostics and treatment of animals of various species;
		GPC-7.5 Uses geoinformation systems and software complexes when collecting and analyzing information related to the assessment of the spread of infectious diseases, epizootic situations, planning and evaluating the effectiveness of anti-epizootic measures.
PC -6	The ability to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.	PC-6.1 Able to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.
		PC-6.2 He is able to develop recommendations on therapeutic and preventive manipulations to prevent diseases, the high probability of which was revealed during the study of the patient.
		PC-6.3 He is able to develop recommendations for carrying out preventive and curative measures based on the results of the examination of animals carried out as part of the medical examination.

3. COURSE IN HIGHER EDUCATION

The discipline "**Maths**" refers to the mandatory part of block B1 of the Educational Program of Higher Education.

As part of the Educational Program of Higher Education, students also master other disciplines and /or practices that contribute to achieving the planned results of mastering the discipline "**Maths**".

Table 3.1. List of Higher Education Program components disciplines that contribute to expected learning outcomes

Competence code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
UK-1	The ability to carry out a critical analysis of problem situations based on a systematic approach, to develop a strategy of action.	Fundamentals of Economics and Management Veterinary deontology The basics of intellectual work Zoopsychology	History Philosophy Life safety Obstetrics, gynecology and andrology Internal diseases General surgery

		Organization of state veterinary supervision Career management Space technologies at the service of the agro-industrial complex Reconstructive surgery	Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Veterinary and sanitary examination Organization of veterinary affairs
UK-2	The ability to manage a project at all stages of its life cycle.	Philosophy Organization of veterinary affairs	Introduction to the specialty Fundamentals of Economics and Management Veterinary deontology Economics and organization of agricultural production The basics of intellectual work Personality psychology and professional self-determination Veterinary and industrial laboratories with design basics Career management Space technologies at the service of the agro-industrial complex
UK-3	The ability to organize and manage the work of the team, developing a team strategy to achieve the goal.	Law science Life safety Operative surgery with topographic anatomy Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases Organization of veterinary affairs	Basics of Rhetoric and Communication Introduction to the specialty Fundamentals of Economics and Management Veterinary sanitation Veterinary deontology The basics of intellectual work Personality psychology and professional self-determination

			Basics of social and legal knowledge
UK-6	The ability to determine and implement the priorities of one's own activity and ways to improve it based on self-assessment and lifelong education.	Philosophy Internal diseases General surgery Private Veterinary Surgery Epizootology and infectious diseases Organization of veterinary affairs	Introduction to the specialty Veterinary deontology The basics of intellectual work Personality psychology and professional self-determination Career management Basics of social and legal knowledge Reconstructive surgery
UK-10	The ability to make informed economic decisions in various areas of life	Veterinary and sanitary examination Organization of veterinary affairs	Fundamentals of Economics and Management Economics and organization of agricultural production Veterinary and industrial laboratories with design basics
UK-12	The ability to search for the necessary sources of information and data, to perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; to evaluate information, its reliability, build logical conclusions based on incoming information and data	Law science Computer science Philosophy Life safety Instrumental diagnostic methods Organization of veterinary affairs Forensic veterinary examination and dissection of animals	Veterinary deontology Medicinal and poisonous plants The basics of intellectual work Personality psychology and professional self-determination Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Organization of state veterinary supervision Veterinary and industrial laboratories with design basics Biometrics in veterinary medicine Basics of social and legal knowledge

			Space technologies at the service of the agro-industrial complex
GPK-4	The ability to use methods of solving problems using modern equipment in the development of new technologies in professional activity and to use modern professional methodology for conducting experimental research and interpreting their results.	Inorganic and analytical chemistry Organic chemistry Biological physics Computer science Physical and Colloidal Chemistry Cytology, Histology and Embryology Biological chemistry Veterinary Microbiology and Mycology Virology and biotechnology Physiology and ethology of animals Breeding with the basics of private animal husbandry Pathological physiology Veterinary radiobiology Clinical diagnostics Pathological anatomy Operative surgery with topographic anatomy Instrumental diagnostic methods Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases	Immunology Veterinary sanitation Processing technology for livestock products Medicinal and poisonous plants Fodder plants The basics of intellectual work Personality psychology and professional self-determination Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry
GPK -7	He is able to understand the	Computer science	The basics of intellectual work

		principles of modern information technologies and use them to solve the tasks of professional activity.	Instrumental diagnostic methods Organization of veterinary affairs	Clinical laboratory diagnostics Laboratory diagnostics of infectious and invasive diseases Veterinary and industrial laboratories with design basics Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery
PK -6	The ability to develop a treatment plan for animals based on the established diagnosis and individual characteristics of animals.	Veterinary genetics Veterinary Microbiology and Mycology Virology and biotechnology Pathological physiology Veterinary pharmacology Toxicology Obstetrics, gynecology and andrology Internal diseases General surgery Private Veterinary Surgery Parasitology and invasive diseases Epizootology and infectious diseases	Immunology Zoopsychology Horse diseases Diseases of Productive Animals Diseases of small pets Болезни мелких домашних животных Diseases of bees and entomophages Fish pathology and aquaculture Diseases of exotic animals Anesthesiology, resuscitation and intensive care Dermatology Cardiology Endocrinology Nephrology Reconstructive surgery Veterinary ophthalmology Animal Dentistry

4. COURSE WORKLOAD AND TRAINING ACTIVITIES

Course workload of the discipline **"Maths"** is 2 credits.

*Table 4.1. Types of academic activities during the period of the HE program mastering for **full-time** study*

Types of academic activities		HOURS	Semesters			
			1	-	-	-
Contact academic hours		18	18	-	-	-
including						
Lectures		-	-	-	-	-
Lab work		-	-	-	-	-
Seminars (workshops/tutorials)		18	18	-	-	-
Self-study		44	44	-	-	-
Evaluation and assessment (exam/pass/fail grading)		10	10	-	-	-
Course workload	Academic hour	**72**	**72**	-	-	-
	Credit unit	**2**	**2**	-	-	-

*Table 4.2. Types of academic activities during the period of the HE program mastering for **part-time** study*

Types of academic activities		HOURS	Semesters			
			1	-	-	-
Contact academic hours		13	13	-	-	-
including						
Lectures		-	-	-	-	-
Lab work		-	-	-	-	-
Seminars (workshops/tutorials)		13	13	-	-	-
Self-study		47	47	-	-	-
Evaluation and assessment (exam/pass/fail grading)		12	12	-	-	-
Course workload	Academic hour	**72**	**72**	-	-	-
	Credit unit	**2**	**2**	-	-	-

5. CONTENT OF THE DISCIPLINE

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

Name of the discipline section	Content of the section (topics)	Types of academic activities
Section 1. Vector Algebra	Topic 1.1 Addition and multiplication of vectors by a number, scalar product of vectors, angle between two vectors.	Seminar classes
Section 2. Operations on Matrices	Topic 2.1 Matrix addition, matrix multiplication by number, zero matrices, square matrices, polynomial of a matrix, unit matrix, product of matrices.	Seminar classes
Section 3. Inverse Matrix	Topic 3.1 Methods for finding the inverse matrix.	Seminar classes

Section 4. Determinants	Topic 4.1 Triangle rules, Laplace's theorem (determinant decomposition by row or column), determinant reduction to triangular form, minors and algebraic complements.	Seminar classes
Section 5. Matrix Rank	Topic 5.1 Matrix rank theorem, matrix column rank theorem, methods of finding an inverse matrix using fringing minors, reducing a matrix to trapezoidal form.	Seminar classes
Section 6. Methods for Solving a System of Algebraic Equations	Topic 6.1 Cramer's formulas, inverse matrix method, Gauss method.	Seminar classes
Section 7. Investigating and Solving a System of Algebraic Equations	Topic 7.1 Application of the Kronecker-Kapelli theorem, system of homogeneous algebraic equations, construction of the fundamental system of solutions.	Seminar classes
Section 8. Complex numbers	Topic 8.1 Geometric representation, forms of recording complex numbers, actions on complex numbers.	Seminar classes
Section 9. Elements of Analytical Geometry	Theme 9.1 Straight line equations on the plane and in space, straight line equations using the concepts of normal vector, straight line equations with angle coefficient, straight line equations in segments.	Seminar classes
Section 10. Second-order curves	Theme 10.1 Equation of the circle, ellipse, hyperbola and parabola, equation of second-order curves.	Seminar classes
Section 11. Equation of a straight line in space	Theme 11.1 A straight line in space, the angle between two straight lines, the conditions of parallelism and perpendicularity of straight lines, the conditions of coplanarity of two straight lines.	Seminar classes
Section 12. Equations of the plane	Topic 12.1 Normal and tangent vector of the plane.	Seminar classes
Section 13. A straight line and a plane in space	Topic 13.1 Angle between a straight line and a plane, conditions of parallelism of a straight line and a plane, conditions of their perpendicularity.	Seminar classes
Section 14. Second-order surfaces	Topic 14.1 The canonical form of second-order surface equations, geometric representation.	Seminar classes
Section 15. The concept of a point and its neighborhood.	Topic 15.1 Interval, half-interval, segment, modulus of a number.	Seminar classes

Section 16. Ways to set a function	Topic 16.1 Analytical, graphical, tabular, verbal methods of assignment.	Seminar classes
Section 17. The concept of the limit of a sequence and a function	Topic 17.1 The concept of continuity of a function at a point and on an interval, the limits theorem, the first remarkable limit, the second remarkable limit, classification of discontinuities.	Seminar classes
Section 18. The concept of a derivative	Topic 18.1 Table of derivatives, basic elementary functions, rule of finding derivatives, higher order derivatives.	Seminar classes
Section 19. Investigating Functions and Drawing Graphs	Theme 19.1 Plan of investigation and construction of a function, asymptotes of a function, the concept of extremes of a function, inflection points.	Seminar classes
Section 20. The Undetermined Integral	Theme 20.1 The most important properties of integration, the first-order function, the table of the simplest integrals, the basic methods of integration.	Seminar classes
Section 21. The Definite Integral	Topic 21.1 Methods of calculation, basic concepts and properties, Newton-Leibniz formula, integration by parts.	Seminar classes
Section 22. Integral Irregularities	Topic 22.1 Integrals with infinite bounds (first kind), integrals from unlimited functions (second kind)	Seminar classes
Section 23. Applications of the Indefinite Integral	Topic 23.1 Calculation of areas of flat figures, calculation of the arc length of a curve, calculation of volumes of bodies.	Seminar classes
Section 24. Functions of several variables	Theme 24.1 Graph and level line, limit of a function at a point, continuity of a function at a point and on a set, partial derivatives, total differential, partial derivatives and higher order differentials.	Seminar classes
Section 25. Directional Derivative and Gradient	Topic 25.1 Definition of directional derivative, definition of gradient, relationship between directional derivative and gradient.	Seminar classes
Section 26. Extremum of functions of two variables	Theme 26.1 Definition of extremum of functions of two variables at a point, extremum of functions in the area, conditional extremum, least squares method.	Seminar classes

6. CLASSROOM INFRASTRUCTURE AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Material and technical support of the discipline

Classroom for Academic Activity Type	Equipping the classroom	Specialized educational/laboratory equipment, software and materials for the development of the discipline (if necessary)
Seminary	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and interim certification, equipped with a set of specialized furniture and multimedia presentation equipment.	-
Self-studies	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and educational environment.	-

7. RECOMMENDED SOURCES FOR COURSE STUDIES

Main reading:

1. Collection of Problems in Mathematics for High Schools: Textbook for High Schools: in 4 parts. Part 1: Linear Algebra and Fundamentals of Mathematical Analysis / V.A. Bolgov; under the editorship of A.V. Efimov, B.P. Demidovich. - 3rd ed., revised; Reprint of the 1993 edition. - Moscow: Alliance, 2014, 2017, 2020. - 480 p.: ill. - ISBN 978-5-91872-051-6. https://lib.rudn.ru/MegaPro/Web/SearchResult/ToPage/2
2. laneev Evgeny Borisovich. Methods of calculations: systems of linear equations, systems of nonlinear equations, search for the minimum of functions, methodv solution of partial derivative equations: tutorial / E. B. Laneev. - Electronic text data. - Moscow: PFUR, 2020. - 115 c. - ISBN 978-5-209-10129-1: 201.42. https://lib.rudn.ru/MegaPro/Web/SearchResult/ToPage/2
3. Pavlov Oleg Ivanovich. Mathematics for Humanities: Practical Manual / O.I. Pavlov, O.Y. Pavlova. - Electronic text data. - M.: RUDN, 2019. - 151 c. - ISBN 978-5-209-09791-4.
4. Pavlyuchenko Yuri Vital'evich. Higher mathematics for the humanities: textbook and practical work for applied baccalaureate / V. Pavlyuchenko Y., Hassan N.S.; under general ed. Pavlyuchenko Y.V.. - 4th ed. revised and extended - Moscow: Yurite, 2019. - 238 p.: ill. - (Bachelor. Applied course). - ISBN 978-5-9916-7037-1.

Additional Reading:

1. Mekeko Natalia Mikhailovna. Translation in Professional Communication: English for Mathematicians: textbook for students of higher education institutions / N.M. Mekekeko, E.V. Tikhonova, E.A. Golubovskaya. - Electronic text data. - Moscow: PFUR, 2022. - 556 c. - ISBN 978-5-209-10489-6: 438.38. https://lib.rudn.ru/MegaPro/Web/SearchResult/ToPage/2
2. Pavlov Oleg Ivanovich. Short Course of Probability Theory and Mathematical Statistics: Tutorial / O.I. Pavlov, O.Y. Pavlova. - Electronic text data. - M.: RUDN, 2019. - 87 c. - ISBN 978-5-209-09790-7.

Resources of the Internet information and telecommunication network:

1. Electronic library system of RUDN and third-party Electronic library systems to which university students have access on the basis of concluded contracts:
- Electronic library system of RUDN - ELS RUDN http://lib.rudn.ru/MegaPro/Web
- ELS "University Library online"http://www.biblioclub.ru
- ELS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant"www.studentlibrary.ru
- ELS "Lan"http://eZlanbook.com/
- ELS "Trinity Bridge"http://www.trmost.com/
2. Databases and search engines:
- electronic fund of legal and regulatory and technical documentation http://docs.cntd.ru/
- search engine Yandex https://www.yandex.ru/
- search engine Google https://www.google.ru/
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/
Educational and methodological materials for independent work of students during the development of the discipline/ module*:
1. A course of lectures on the discipline "**Maths**".
2. Seminary workshop on the discipline "**Maths**".
> * - 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 and Information System!**

8. MID-TERM ASSESSMENT

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 "**Maths**" are presented in the Appendix to this Work Program of the discipline.
> * - Assessment Materials and a Point Rating System are formed based on the requirements of the relevant local regulatory act of the RUDN.

DEVELOPER:

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