

Discipline annotation

Discipline name	Algebra / Algebra
Summary	<p>Basic algebraic structures. Internal binary operations on a set and their properties. Definition and elementary properties of semigroups and groups. Ring definition. Commutative ring, ring with identity. Ring of integers, ring with zero multiplication. Zero Divisors. Invertible elements of a ring with identity. Field definition, no zero divisors. Field of rational numbers, field of real numbers, field of two elements. Construction of the field of complex numbers. The algebraic form of a complex number. Geometric representation and trigonometric form of complex numbers. Moivre-Laplace formula. Extraction of a root from a complex number. Roots from unity.</p> <p>The ring of matrices over a ring. Matrices over a field. Matrices over a ring. Matrix addition, multiplication by an element of the ring. Matrix multiplication. Ring of square matrices. Determinant of a square matrix of n-th order over a commutative ring. Determinants properties Minors and algebraic complements. Laplace's theorem, corollaries. Determinant of product of matrices. Definition and calculation of the inverse matrix for a matrix over a commutative ring with identity. Elementary transformations of matrices over a ring with identity. Equivalent matrices. The rank of the matrix. Row equivalence of a matrix over a field to a step matrix. Matrix rank properties. Linear dependence and independence of systems of arithmetic n-dimensional vectors over a field. Basis and rank of the vector system. Coincidence of the rank of a system of vectors with the rank of the matrix composed of them.</p> <p>Systems of linear equations over a field. Systems of linear inequalities Basic concepts: solution, consistency. Consistency criteria, criteria for the uniqueness of the solution of a consistent system of equations. Equivalent systems of equations. Description of the set of solutions of a consistent system of equations. Gauss method. Cramer's rule. Homogeneous systems of linear equations. Fundamental system of solutions and its properties. Connection between solutions of associated systems of equations. Corollary fact from the system of linear equations. Support solutions of the system of linear equations. A criterion for a consistent system of linear equations over the field of real numbers to have a non-negative solution. Systems of linear inequalities and their reduction to a system of linear equations. Corollary fact from the system of linear inequalities. Minkowski's theorem. Consistency criterion of a system of linear inequalities.</p>
Learning outcomes of the discipline	<p>- carries out the selection and systematization of the main properties of the most important algebraic structures; fundamentals of linear algebra; fundamentals of analytical geometry.</p> <p>- operates with elements of numerical fields, linear spaces, linear operators, matrices, vectors, linear and non-linear geometric objects; solves systems of linear equations; applies algebraic methods to solve geometric problems; applies algebraic and geometric methods to solve applied problems, as well as evaluates the quality of the solutions obtained; demonstrates the ability to abstract, including the ability to logically develop individual formal theories and establish a connection between them.</p> <p>- able to use mathematical methods and software technologies for working with algebraic structures to solve professional tasks.</p>

Workload, c. u.	5c. u.
Reporting Forms	Exam - 1st semester
List of essential and supplementary literature necessary for mastering the discipline	
Essential literature	<ol style="list-style-type: none"> 1. Ilyin V. A., Kim G. D. Linear Algebra and Analytic Geometry. - M.: TK Velby, Prospekt Publishing House, 2015. 2. Glukhov M. M. Algebra [Electronic source]: textbook / M. M. Glukhov, V. P. Elizarov, A. A. Nechaev. – Electronic data - St. Petersburg: Lan, 2015. - 607 p. Available at: http://e.lanbook.com/books/element.php?pl1_id=67458
Supplementary literature	<ol style="list-style-type: none"> 1. Beklemisheva, L. A. Collection of problems in analytical geometry and linear algebra [Electronic source]: study guide / L. A. Beklemisheva, D. V. Beklemishev, A. Yu. Petrovich [et al.]. – Electronic data - St. Petersburg. : Lan, 2016. - 496 p. – Available at: http://e.lanbook.com/books/element.php?pl1_id=72575 2. Butuzov V. F., Krutitskaya N. Ch., Shishkin A. A. Linear algebra in questions and problems. - St. Petersburg: Lan, 2008. 3. Vinberg E. B. Algebra course [Electronic source]: textbook. — Electronic data. - M.: MCCME (Moscow Center for Continuous Mathematical Education), 2013. - 591 p. – Available at: http://e.lanbook.com/books/element.php?pl1_id=56396. 4. Voevodin V. V. Linear algebra. - St. Petersburg: Lan, 2008. 5. Kostrikin A. I. Introduction to algebra. Part II. Linear Algebra: A Textbook for High Schools.- M.: MCCME, 2012.