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MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution
higher education
NORTH CAUCASIAN FEDERAL UNIVERSITY

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WORKING PROGRAM OF THE DISCIPLINE
"Linear Algebra"

Direction of training	11.03.02 Infocommunication technologies and communication systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of commencement of studies	2026
Form of study	full-time
Implemented in a semester	1

Developed by
Associate Professor of the Department of
Mathematical Modeling of the Faculty of
Mathematics and Computer Science named
after Professor N.I. Chervyakov
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1. The purpose and objectives of mastering the discipline (module) .

The objective of mastering the discipline: the formation of general professional competence OPK-1 of a future bachelor in the field of training 11.03.02 - Infocommunication technologies and communication systems.

Objectives of mastering the discipline :

- familiarization with the basics of linear algebra;
- training in basic linear-algebraic methods for solving engineering problems.

2. The place of the discipline (module) in the structure of the educational program

The discipline "Linear Algebra" is one of the compulsory disciplines.

3. List of planned learning outcomes for the discipline (module), correlated with the planned learning outcomes for the educational program

Code, formulation of competence	Code, indicator formulation	Planned learning outcomes for the discipline (module), characterizing the stages of formation of competencies, indicators
OPK-1. Able to use principles, laws, and methods of natural science and mathematics to solve engineering problems.	ID-1 OPK-1 understands the fundamental laws of nature and the basic physical mathematical laws and methods of accumulation, transmission and processing of information.	Willingness to solve a problem in your professional activity, relying on provisions, laws and methods of natural sciences and mathematics.
	ID-2 OPK-1 applies physical laws and mathematical methods to solve theoretical and applied problems .	
	ID-3 OPK-1 uses knowledge of physics and mathematics when solving practical problems.	

4. Volume of the academic discipline (module) and forms of control

Amount of classes: total: 5 credits, 180 academic hours.	OFO, In academic hours
Contact work:	40.00/0
Lectures/including practical training	0
Laboratory work /including practical training	0
Practical classes /including practical training	40.00/0
Independent work	86.00
Forms of control	
Exam	54.00
Credit	-
Credit with grade	-
Coursework	No

5. The content of the discipline, structured by topics (sections) indicating the number of hours and types of classes

No.	Section (topic) of the discipline and brief content	Developed competencies, indicators	full-time education				Forms of the current control academic performance
			Contact work of students with a teacher/of which in the form of practical training, hours			Independent work, hours	
			Lectures	Practical classes	Laboratory work		
1	Binary operations on sets and their properties. Semigroups and groups. Rings and fields. Practical work No. 1 Binary algebraic operations and their basic properties	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		8	interview
2	Field of complex numbers. Practical work #2 Multiplication and division of complex numbers in trigonometric form. Extracting the n th root of a complex number	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		8	interview
3	Matrices over a ring and operations on them. Practical work #3 Matrices over a ring and operations on them	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		10	interview
4	Determinant of a matrix over a commutative ring. Practical work #4 Definition and properties of the determinant of a square matrix of order n	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		10	interview
5	Inverse matrix. Elementary matrix transformations. Matrix rank and its calculation. Practical work #5 Inverse matrix and its calculation	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		10	interview
6	Arithmetic n -dimensional vectors over a field. Linear dependence and independence of systems of arithmetic vectors. Practical work #6 Arithmetic n -dimensional vectors	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		10	interview

7	Basic concepts of the theory of solving systems of linear equations. Methods for solving systems of linear equations. Practical work #7	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		6		10	inter-view
8	Homogeneous and inhomogeneous systems of linear equations. Practical work #8 Basic concepts of the theory of solving systems of linear equations. Solving systems of linear equations in matrix form	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		8		10	inter-view
9	Systems of linear inequalities. Practical work #9 Solution of systems of linear equations by Gauss's method	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1		8		10	inter-view
	EXAM					54.00	
	TOTAL			40.00		140.00	

6. Fund of assessment tools for conducting ongoing monitoring of academic performance and midterm assessment of students in a discipline (module)

The Assessment Toolkit (AT) for ongoing performance monitoring and midterm assessment of students in the course (module) " Linear Algebra" is based on a list of mastered competencies, indicating the stages of their development during the course (module) mastery. The AT provides objective monitoring of the achievement of planned learning outcomes. The AT includes:

- description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales;
- methodological materials defining the procedures for assessing knowledge, skills, abilities and (or) work experience, characterizing the stages of competence development;
- standard test assignments and other materials necessary for assessing knowledge, skills and the level of mastery of the developed competencies in the process of mastering the discipline (module).

FOS is an appendix to this discipline (module) program.

7. Methodological guidelines for students on mastering the discipline

When starting work, each student should take into account the following provisions.

The discipline (module) is structured on a thematic principle, each topic is a logically complete section.

The lecture material is devoted to the examination of key, basic provisions of the courses and an explanation of the educational assignments assigned to students for independent work.

Practical classes are held with the aim of consolidating the acquired information and acquiring skills for its application in solving practical problems in the relevant subject area.

Students' independent work is aimed at independent study of additional material, preparation for practical classes, and completion of all types of independent work.

To successfully master the course, it is necessary to complete all types of independent work using the recommended sources of information.

8. Educational, methodological and informational support of the discipline

8.1. List of basic and additional literature required for mastering the discipline (module)

8.1.1. List of primary literature:

1. Ilyin V.A., Kim G.D. Algebra and analytic geometry. – M.: TC Welby, Izd-vo Prospekt, 2020.

2. Glukhov M.M. Algebra [Electronic resource]: textbook / M.M. Glukhov, V.P. Elizarov, A.A. Nechayev. – Electron.dan. - SPb.: Lan, 2021. - 607 s. Access mode: http://e.lanbook.com/books/element.php?pl1_id=67458

8.1.2. List of additional literature:

1. Beklemisheva, L.A. Collection of problems in analytical geometry and linear algebra [Electronic resource]: textbook / L.A. Beklemisheva, D.V. Beklemishev, A.Yu. Petrovich [et al.]. – Electron.dan. – St. Petersburg: Lan, 2019. – 496 p. – Access mode: http://e.lanbook.com/books/element.php?pl1_id=72575

2. Butuzov V.F., Krutitskaya N.Ch., Shishkin A.A. Algebraic questions and problems. – St. Petersburg: Lan, 2208.

3. Vinberg E.B. Algebra Course [Electronic resource]: textbook. - Electron.dan. - M.: MCNE (Moscow Center for Continuous Mathematical Education), 2021. - 591 p. - Access mode: http://e.lanbook.com/books/element.php?pl1_id=56396.

4. Voevodin V.V. Algebra. – St. Petersburg: Lan, 2019.

5. Kostrikin A.I. Introduction to Algebra. Part II. Algebra: Textbook for Universities. Moscow: Moscow Center for Continuous Mathematical Education, 2020.

8.2. List of educational and methodological support for independent work of students in a discipline (module)

1. Guidelines for conducting practical classes in the discipline "Linear Algebra": Training program 11.03.02 - Infocommunication Technologies and Communication Systems. Training profile - Intelligent data processing in infocommunication systems and networks. Graduate qualification - Bachelor's degree. Full-time. Curriculum for 2023.

2. Guidelines for organizing independent student work in the course "Linear Algebra": 11.03.02 - Infocommunication Technologies and Communication Systems. Training profile: Intelligent data processing in infocommunication systems and networks. Graduate qualification: Bachelor's degree. Full-time. 2023 curriculum.

8.3. List of resources of the information and telecommunications network "Internet" required for mastering the discipline (module)

1. <http://www.allmath.ru/> All mathematics – higher mathematics, applied mathematics, mathematical methods in economics, financial mathematics.

2. <http://www.exponenta.ru/> Educational mathematics site.

3. <http://www.Math-Net.ru/> The All - Russian Mathematics Portal is a modern information system offering Russian and international mathematicians various opportunities to [find information about mathematical life in Russia](#). Main sections: journals, personalities, organizations, conferences, seminars, video library, and library.

9. List of information technologies used in the implementation of the educational process in the discipline (module), including a list of software and information reference systems

Lectures are delivered using computers and multimedia presentations. During seminars and practical classes, students present presentations they prepared during their independent work hours.

Information reference systems:

Information and reference and information and legal systems used in the study of the discipline:

Software:

- 1 Alt Workstation 10
- 2 Alt Workstation K
- 3 Alt "Server"

10. Description of the material and technical base necessary for the implementation of the educational process in the discipline (module)

Lecture classes	The lecture hall is equipped with specialized furniture and technical teaching aids for presenting educational information to a large audience, including a laptop and a projector. Visual aids include topical presentations corresponding to the course syllabi.
Practical classes	The classroom for seminar-type classes is equipped with specialized furniture and technical teaching aids for presenting educational information, including a projector and interactive whiteboard. Internet access is available, as is access to the university's educational network.
Independent work	A room for independent student work, equipped with computers and internet access, providing access to an electronic information and educational environment.
Practical training	It is carried out in the structural divisions of the university and (or) in organizations operating in the profile of the relevant educational program, including its structural division

11. Features of mastering the discipline (module) by persons with disabilities

Students with disabilities are provided with special textbooks, teaching aids and didactic materials, special technical teaching aids for collective and individual use, the services of an assistant (helper) who provides students with the necessary technical assistance, as well as the services of sign language interpreters and tactile sign language interpreters.

The acquisition of a discipline (module) by students with disabilities can be organized jointly with other students, as well as in separate groups.

The acquisition of a discipline (module) by students with disabilities is carried out taking into account the characteristics of psychophysical development, individual capabilities and health status.

In order to ensure accessibility of higher education under the educational program for individuals with disabilities, the following is provided when mastering a discipline (module):

1) for persons with visual impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),

- written assignments, as well as instructions on how to complete them, are written in large print,

- special textbooks, teaching aids and didactic materials (with large print or audio files),

- individual uniform illumination of at least 300 lux,

- if necessary, the student is provided with a magnifying device to complete the assignment;

2) for persons with hearing impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),

- the availability of sound amplification equipment for collective use is ensured; if necessary, the student is provided with sound amplification equipment for individual use;

- is provided with appropriate sound means for reproducing information;

3) for persons with disabilities who have musculoskeletal disorders (including severe impairments of the motor functions of the upper limbs or the absence of upper limbs):

- written assignments are completed on a computer with specialized software or dictated to an assistant;

- at the student's request, assignments can be completed orally.

12. Features of the implementation of the discipline using distance learning technologies and e-learning

According to Part 1 of Article 16 of Federal Law No. 273-FZ of December 29, 2012, "On Education in the Russian Federation," *e-learning* is defined as the organization of educational activities using information contained in databases and used in the implementation of educational programs, as well as information technologies, technical means, and information and telecommunications networks that facilitate the transmission of said information over communication lines, as well as interaction between students and teaching staff. *Distance learning technologies* are educational technologies implemented primarily using information and telecommunications networks through indirect (remote) interaction between students and teaching staff.

The course may be delivered using distance learning technologies and e-learning, in whole or in part. The components of the course's teaching and methodological kit (the course curriculum, assessment and methodological materials, and assessment forms) implemented using distance learning technologies and e-learning contain instructions for their use.

When organizing educational activities using distance learning technologies and e-learning, asynchronous and synchronous methods of interaction between participants in educational relations may be provided through the Internet information and telecommunications network.

When using distance learning technologies and e-learning, the curriculum for the discipline shall indicate: methods of interaction between participants in educational relations via the Internet (videoconferencing, electronic testing); links to the SKFU electronic information and educational environment, to educational platforms and resources of other organizations that are openly accessible via the Internet; for synchronous learning - the time of online classes and teachers; for asynchronous learning - the authors of online courses.

When organizing midterm assessments using distance learning technologies and e-learning, the Methodological Recommendations for the Application of Technical Means Ensuring the Objectivity of Results during Midterm and State Final Assessments for Higher Education Programs—Bachelor's Degree Programs, Specialist Programs, and Master's Degree Programs Using Distance Learning Technologies—are used (Letter of the Ministry of Education and Science of the Russian Federation dated December 7, 2020, No. MN-19/1573-AN "On the Submission of Methodological Recommendations").

The implementation of the course using e-learning and distance learning technologies is carried out using the electronic information and educational environment of SKFU, to which students have access via the information and telecommunications network "Internet", or using the resources of other organizations, including platforms providing services for video conferencing, online meetings and distance learning (MTS-Link), as well as using the capabilities of social networks for communication between students and teachers.

The educational and methodological support for a discipline implemented using e-learning and distance learning technologies includes a work program, educational and methodological manuals or a course of lectures, methodological instructions for the implementation of various types of educational activities of students provided for by the discipline, and other educational and methodological materials posted in the information and educational environment of SKFU, presented in electronic form.