Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia named after Patrice Lumumba"

Academy of Engineering

(name of the main educational unit (MEU) that developed the educational program of higher education)

WORKING PROGRAM OF THE DISCIPLINE

DISCRETE MATHEMATICS

(name of discipline/module)

Recommended for the field of study/specialty:

27.03.04 CONTROL IN TECHNICAL SYSTEMS

(code and name of the training area/specialty)

The discipline is mastered within the framework of the implementation of the main professional educational program of higher education (EP HE):

DATA SCIENCE AND SPACE SYSTEMS

(name (profile/specialization) of the educational institution of higher education)

2025

1. THE GOAL OF MASTERING THE DISCIPLINE

The course "Discrete Mathematics" is part of the bachelor's program "Data Science and Space Systems" in the direction 27.03.04 "Control in Technical Systems" and is studied in the 3rd semester of the 2nd year. The course is implemented by the Department of Mechanics and Control Processes. The course consists of 3 sections and 15 topics and is aimed at studying The main principles of set theory, algebra of logic and graph theory. Particular attention is paid to the analysis of methods for solving typical problems and the analysis of their application in professional activity.

The goal of mastering the discipline is to increase the level of mathematical literacy, formation of fundamental knowledge and skills of application of Discrete Mathematics methods necessary for professional activity and mastering subsequent disciplines.

2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Discrete Mathematics" is aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies developed in students while mastering the discipline (results of mastering the discipline)

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
PC-1	Capable of collecting, processing and interpreting modern scientific research data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	PC-1.1 Knows modern methods of collecting, processing and interpreting data from modern scientific research necessary for drawing conclusions on relevant scientific research; PC-1.2 Able to apply modern methods and tools for processing and interpreting scientific research data; PC-1.3 Possesses the basic skills of collecting, processing and interpreting data from modern scientific research necessary for drawing conclusions on relevant scientific research;

3. PLACE OF THE DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL EDUCATIONAL EDUCATION

Discipline "Discrete Mathematics" refers to the part formed by the participants of educational relations of block 1 "Disciplines (modules)" of the educational program of higher education.

As part of the higher education program, students also master other disciplines and/or practices that contribute to the achievement of the planned results of mastering the discipline "Discrete Mathematics".

Table 3.1. List of components of the educational program of higher education that contribute to the achievement of the planned results of mastering the discipline

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
PC-1	Capable of collecting, processing and interpreting modern scientific research data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	Computer Science and Programming;	Space Flight Mechanics; Numerical Methods; Automatic Control Theory; *Virtual and Augmented Reality Technology**; Virtual and augmented reality technologies**; Computer Science and Programming;

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
			Optimal Control Methods; Analysis of Geoinformation Data; Research work / Scientific research work; Technological Training; Undergraduate Training;

* - filled in in accordance with the competency matrix and the SUP EP HE
** - elective disciplines/practices

4. SCOPE OF THE DISCIPLINE AND TYPES OF STUDY WORK

The total workload of the "Discrete Mathematics" course is 2 credits.

Table 4.1. Types of educational work by periods of mastering the educational program of higher education for full-time education.

Type of academic work	TOTAL,ac.h.		Semester(s) 3
Contact work, academic hours	*36*		*36*
Lectures (LC)	18		18
Laboratory work (LW)	18		18
Practical/seminar classes (SC)	0		0
Independent work of students, academic hours	*27*		*27*
Control (exam/test with assessment), academic hours	*9*		*9*
General complexity of the discipline	**ac.h.**	72	72
	credit.ed.	2	2

5. CONTENT OF THE DISCIPLINE

Table 5.1. Contents of the discipline (module) by types of academic work

Section number	Name of the discipline section		Section Contents (Topics)	Type of academic work*
Section 1	The theory of sets	1.1	Basic concepts. Operations on sets and their properties. Venn diagrams. Binary and equivalence relations	LC, LW
		1.2	Options, properties of observations. Product of mappings, inverse mapping. permutations of n-th order	LC, LW
		1.3	Algebraic laws. The inner law of composition. Generalized associativity. External law of composition	OK
Section 2	Logic of statements	2.1	Expressions and logical connectives. Truth table. Conditional statements	LC, LW
		2.2	Equivalent statements. Laws of propositional logic	LC, LW
		2.3	Axiomatic systems: conclusions and proofs. Completeness in the logic of statements	LC, LW
		2.4	Carnot cards. Commutation schemes	LC, LW
		2.5	Predicate calculus	LC, LW
		2.6	Basic premises of proof theory. Mathematical induction	LC, LW
Section 3	Theories of graphs	3.1	Basic concepts. Ways of defining graphs. Incidence and adjacency matrices	LC, LW
		3.2	Paths and loops. Connectivity of graphs. Euler paths and loops	LC, LW
		3.3	Oriented and weighted graphs	OK
		3.4	Hypercubes and Gray's code	LC, LW
		3.5	Passing graphs in width and depth, path reconstruction with minimal number of intermediates	LC, LW
		3.6	Finding shortest path, Daikstra's algorithm	LC, LW

* - filled in only for FULL-TIME education: LC – lectures; LW – laboratory work; SC – practical/seminar classes.

6. LOGISTIC AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support of the discipline

Audience type	Equipping the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means for multimedia presentations.	
Computer class	A computer room for conducting classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with personal computers (15 units), a board (screen) and technical means for multimedia presentations.	

Audience type	Equipping the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
For independent work	A classroom for independent work of students (can be used for conducting seminars and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information System.	

* - the audience for independent work of students MUST be indicated!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

Main literature:

1. Anderson, D. A. Discrete Mathematics and combinatorics. Editor's note: English translation -M. : Publishing House "Williams". 2004. -960p

2. Erusalimsky. M. Discrete Mathematics. Theory and practice [Electronic resource]:textbook. -Saint Petersburg: Lan', 2018. -476 p.

3. Melikhov, AN Oriented graphs and finite automata. -M.: NaUCa, 1971. -416 p

Further reading:

1. Shevelev Yu. P. Discrete Mathematics [Electronic resource]: tutorial. -Sankt - Petersburg: Lan', 2019. -592 p

2. Gavrilov GP, Sapozhenko AA Tasks and exercises in the course of Discrete Mathematics. -M.: Publishing house NaUCa, 2009 -416 p. -ISBN 978-5-9221-0477-7

Resources of the information and telecommunications network "Internet":

1. RUDN University EBS and third-party EBSs to which university students have access on the basis of concluded agreements

    - Electronic library system of RUDN - ELS RUDNhttp://lib.rudn.ru/MegaPro/Web

    - Electronic library system "University library online"http://www.biblioclub.ru

    - EBS Yuraithttp://www.biblio-online.ru

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

    - Electronic library system "Troitsky Bridge"

2. Databases and search engines

    - electronic fund of legal and normative-technical documentationhttp://docs.cntd.ru/

    - Yandex search enginehttps://www.yandex.ru/

    - search engineGoogle https://www.google.ru/

    - abstract databaseSCOPUS http://www.elsevierscience.ru/products/scopus/

Educational and methodological materials for independent work of students in mastering a discipline/module*:

1. Lecture course on the subject "Discrete Mathematics".

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

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