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

Academy of Engineering

(name of the main educational unit (POU) - developer of the EP HE)

COURSE SYLLABUS

DISCRETE MATHEMATICS

(name of discipline/module)

Recommended by the Didactic Council for the Education Field of:

27.03.04 CONTROL IN TECHNICAL SYSTEMS

(code and name of the area of training/specialty)

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

DATA ENGINEERING AND SPACE SYSTEMS CONTROL

(name (profile/specialization) EP HE)

2024

1. GOAL OF DISCIPLINE MASTERING

The discipline "Discrete mathematics" is included in the undergraduate program "Data Engineering and Space Systems Control" in the direction of 27.03.04 "Control in Technical Systems" and is studied in the 3rd semester of the 2nd year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 3 sections and 15 topics and is aimed at studying The discipline is aimed at studying the foundations of set theory, algebra of logic and graph theory. Particular attention is paid to the analysis of methods for solving typical problems and analysis of the scope of their application in professional activities.

The purpose of mastering the discipline is to increase the level of mathematical literacy, the formation of fundamental knowledge and skills in applying the methods of discrete mathematics, necessary for professional activities and the development of subsequent disciplines.

2. REQUIREMENTS FOR 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 formed in students when mastering the discipline (results of mastering the discipline)

Cipher	Competence	Indicators of Competency Achievement (within 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 how to collect, process and interpret modern scientific research data necessary to form 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 modern scientific research data necessary to form conclusions on relevant scientific research;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

Discipline "Discrete Mathematics" refers to the part formed by the participants in educational relations of block 1 "Disciplines (modules)" 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 the achievement of the planned results of mastering the discipline "Discrete Mathematics".

Table 3.1. List of components of EP HE that contribute to achieving the planned results of mastering the discipline

Cipher	Name of competency	Previous disciplines/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;	Research work / Scientific research work; Technological Training; Undergraduate practice / Pre-graduate practice; Space Flight Mechanics; Numerical Methods; Automatic Control Theory;

Cipher	Name of competency	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
			*Virtual and Augmented Reality Technology**;* *Virtual and augmented reality technologies**;* Computer Science and Programming; Optimal Control Methods; Analysis of Geoinformation Data;

* - to be filled out in accordance with the competency matrix and SUP EP VO

** - elective disciplines/practices

4. SCOPE OF DISCIPLINE AND TYPES OF STUDY WORK

The total labor intensity of the discipline "Discrete mathematics" is "2" credit units.

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

Type of educational work	TOTAL,ac.ch.		Semester(s)
			3
Contact work, ac.ch.	36		36
Lectures (LC)	18		18
Laboratory work (LR)	18		18
Practical/seminar sessions (SZ)	0		0
Independent work of students, ac.ch.	27		27
Control (exam/test with assessment), academic degree.	9		9
Total labor intensity of the discipline	**ac.ch.**	72	72
	credit units	2	2

5. CONTENT OF DISCIPLINE

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

Section number	Name of the discipline section		Contents of the section (topic)	Type of educational work*
Section 1	Set theory	1.1	Basic concepts. Operations on sets and their properties. Venn diagrams. Binary relation and equivalence relation	LK, LR
		1.2	Mappings, properties of mappings. Product of mappings, inverse mapping. nth order permutations	LK, LR
		1.3	Algebraic laws. Internal law of composition. Generalized associativity. External law of composition	OK
Section 2	Propositional logic	2.1	Statements and logical connectives. Truth table. Conditional statements	LK, LR
		2.2	Equivalent statements. Laws of propositional logic	LK, LR
		2.3	Axiomatic systems: inferences and proofs. Completeness in propositional logic	LK, LR
		2.4	Carnot maps. Switching circuits	LK, LR
		2.5	Predicate calculus	LK, LR
		2.6	Basic provisions of the theory of evidence. Mathematical induction	LK, LR
Section 3	Graph theory	3.1	Basic concepts. Methods for specifying graphs. Incidence and adjacency matrices	LK, LR
		3.2	Paths and cycles. Graph connectivity. Euler paths and cycles	LK, LR
		3.3	Directed and weighted graphs	OK
		3.4	Hypercubes and Gray code	LK, LR
		3.5	Breadth-first and depth-first graph traversal, path recovery with the least number of intermediaries	LK, LR
		3.6	Finding the shortest path, Dijkstra's algorithm	LK, LR

* - to be filled out only for full-time education: LC – lectures; LR – laboratory work; SZ – practical/seminar classes.

6. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support of the discipline

Audience type	Auditorium equipment	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; board (screen) and technical means of multimedia presentations.	
Computer class	A computer class for conducting classes, group and individual consultations, ongoing monitoring and intermediate certification, equipped with personal computers ([Parameter] pcs.), a whiteboard (screen) and technical means for multimedia presentations.	

Audience type	Auditorium equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
For independent work	An auditorium for independent work by students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to EIOS.	

* - the audience for independent work of students is MANDATORY!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF DISCIPLINE

Main literature:

1. Anderson, D.A. Discrete mathematics and combinatorics. : Per. from English – M.: Williams Publishing House.2004. - 960 p.

2. Yerusalimsky Ya. M. Discrete mathematics. Theory and workshop [Electronic resource]: textbook. - St. Petersburg: Lan, 2018. - 476 p.

3. Melikhov, A.N. Directed graphs and finite state machines. – M.: Nauka, 1971. – 416 p.

Additional literature:

1. Shevelev Yu. P. Discrete mathematics [Electronic resource]: textbook. - St. Petersburg: Lan, 2019. - 592 p.

2. Gavrilov G.P., Sapozhenko A.A. Problems and exercises for the discrete mathematics course. – M.: Publishing house Nauka, 2009 – 416 p. –ISBN 978-5-9221-0477-7

Resources of the information and telecommunications network "Internet":

1. EBS of RUDN University and third-party EBS, to which university students have access based on concluded agreements

- Electronic library system of RUDN University - EBS RUDN Universityhttp://lib.rudn.ru/MegaPro/Web

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

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

- EBS "Student Consultant"www.studentlibrary.ru

- EBS "Trinity Bridge"

2. Databases and search engines

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

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

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

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

Educational and methodological materials for students' independent work when mastering a discipline/module*:

1. A course of lectures on the discipline "Discrete Mathematics".

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

8. ASSESSMENT MATERIALS AND POINT-RATING SYSTEM FOR ASSESSING THE LEVEL OF COMPETENCIES FOR A DISCIPLINE

Evaluation materials and point-rating system* for assessing the level of development of competencies (parts of competencies) based on the results of mastering the discipline"Discrete Mathematics" are presented in the Appendix to this Work Program of the discipline.

* - OM and BRS are formed on the basis of the requirements of the relevant local regulatory act of RUDN University.

DEVELOPER:

Assistant professor		Saltykova Olga Alexandrovna
Position,	*Signature*	*Last name I.O.*

HEAD OF DEPARTMENT:

Head of the department		Razumny Yuri Nikolaevich
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HEAD OF EP HE:

Professor		Razumny Yuri Nikolaevich
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