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

APPLIED STATISTICS
(name of discipline/module)

Recommended for the field of study/specialty:

27.04.04 CONTROL IN TECHNICAL SYSTEMS
(code and name of the field of study/specialty)

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

Artificial Intelligence, Machine Learning, and Space Science
(name (profile/specialization) of the educational institution of higher education)

2026

1. THE GOAL OF MASTERING THE DISCIPLINE

The course "Applied Statistics" is part of the Master's program "Artificial Intelligence, Machine Learning, and Space Sciences" in the 27.04.04 "Control in Technical Systems" program and is studied in the first semester of the first year. The course is offered by the department of the partner university. It consists of four sections and 18 topics and focuses on the study of basic methods for constructing databases and data banks, modern database management systems, and the acquisition of practical skills in constructing databases and data banks.

The purpose of mastering the discipline is to develop the student's competencies in the field of constructing databases and data banks, studying database management systems and their use in creating information systems for various technological processes and industries based on current methodological and regulatory documents and technical documentation.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Applied Statistics" 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 Competency Achievement** (within this discipline)
GPC-1	Able to analyze and identify the natural scientific essence of control problems in technical systems based on provisions, laws and methods in the field of natural sciences and mathematics	GPC-1.1 Knows the basic laws, provisions and methods in the field of natural sciences and mathematics; GPC-1.2 Able to identify the natural scientific essence of control problems in technical systems guided by the laws and methods of natural sciences and mathematics; GPC-1.3 Proficient in tools for analyzing control problems in technical systems;
GPC-2	Able to formulate control problems in technical systems and justify methods for solving them	GPC-2.1 Knows the basic methods of solving control problems in technical systems; GPC-2.2 Able to justify methods for solving control problems in technical systems; GPC-2.3 Proficient in methods of setting control problems in technical systems;
GPC-3	Capable of independently solving control problems in technical systems based on the latest advances in science and technology	GPC-3.1 Knows the basic approaches to solving control problems in technical systems; GPC-3.2 Able to apply basic approaches based on the latest achievements of science and technology to solving control problems in technical systems; GPC-3.3 Proficient in methods of solving control problems in technical systems based on the latest achievements of science and technology;

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

Discipline "Applied Statistics" refers to the mandatory part 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 "Applied Statistics".

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, practical training*	Subsequent disciplines/modules, practices*
GPC-1	Able to analyze and identify the natural scientific essence of control problems in technical systems based on provisions, laws and methods in the field of natural sciences and mathematics		Undergraduate practice / Pre-graduation practice; Geoinformation Systems and Applications;
GPC-2	Able to formulate control problems in technical systems and justify methods for solving them		Undergraduate practice / Pre-graduation practice;
GPC-3	Capable of independently solving control problems in technical systems based on the latest advances in science and technology		Undergraduate practice / Pre-graduation practice; Research work / Scientific research work (acquiring primary skills in scientific research work); Advanced Methods of Space Flight Mechanics;

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

4. SCOPE OF THE DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total workload of the discipline "Applied Statistics" is 5 credit units.

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,**academic hours		**Semester(s)**
			1
Contact work, academic hours	*34*		*34*
Lectures (LC)	17		17
Laboratory work (LW)	0		0
Practical/seminar classes (SC)	17		17
Independent work of students, academic hours	*110*		*110*
Control (exam/test with assessment), academic hours	*36*		*36*
Total complexity of the discipline	**academic hours**	***180***	*180*
	credit	***5***	*5*

5. CONTENT OF THE DISCIPLINE

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

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
Section 1	Force	1.1	Fundamentals	Introduction to the concept of force in a statistical mechanics or engineering context. Definition of a force as an interaction that causes a change in motion or deformation. Vector and scalar representations.	LC, SC
		1.2	Force	Characteristics of force: magnitude, direction, and point of application. Classification of forces: contact forces and body forces (gravitational, electromagnetic).	LC, SC
		1.3	Resolution of a force	Decomposition of a force into components. Rectangular (orthogonal) and non-rectangular components. Practical applications of force resolution.	LC, SC
		1.4	Moment of a force	Definition of the moment (torque) of a force about a point and about an axis. Calculation of the moment arm. Sign conventions (clockwise vs. counterclockwise). Varignon's theorem.	LC, SC
		1.5	Force system	Classification of force systems: coplanar and non-coplanar, concurrent and non-concurrent, parallel and general force systems. Resultant of a force system.	LC, SC
		1.6	Composition of Forces	Determination of the resultant of multiple forces acting on a body. Methods of composition: parallelogram law, triangle law, and polygon law. Graphical and analytical approaches.	LC, SC
Section 2	Equilibrium	2.1	Definition, conditions of equilibrium	Definition of a body in equilibrium. Translational equilibrium (zero net force) and rotational equilibrium (zero net moment). Necessary and sufficient conditions for equilibrium in two and three dimensions.	LC, SC
		2.2	Lami's Theorem	Statement of Lami's theorem for three concurrent, coplanar, and non-collinear forces in equilibrium. Conditions for application. Practical examples and problem-solving techniques.	LC, SC
		2.3	Equilibrant	Definition of the equilibrant force as a force that brings a system into equilibrium. Relationship between the resultant and the equilibrant (equal in magnitude, opposite in direction, collinear in action). Determination of the equilibrant in various force systems.	LC, SC
		2.4	Beams	Introduction to beams as structural elements. Types of beams: simply supported, cantilever, overhanging, fixed beams. Types of loads: point loads, uniformly distributed loads, uniformly varying	LC, SC

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
				loads. Support reactions and their determination using equilibrium conditions.	
Section 3	Center of Gravity and Friction	3.1	Centroid	Definition of the centroid as the geometric center of a plane figure or a solid body. Centroid of standard shapes (rectangle, triangle, circle, semicircle). Determination of centroids of composite bodies using the method of moments.	LC, SC
		3.2	Center of gravity	Definition of the center of gravity as the point where the entire weight of a body is assumed to act. Distinction between centroid (geometric) and center of gravity (gravitational). Methods for locating the center of gravity of irregular and composite bodies.	LC, SC
		3.3	Definition of friction, force of friction	Introduction to friction as a force resisting relative motion between surfaces in contact. Classification: static friction, kinetic (dynamic) friction, rolling friction. The force of friction: magnitude, direction, and dependence on normal reaction. Laws of dry (Coulomb) friction.	LC, SC
		3.4	Equilibrium of bodies on level plane	Analysis of bodies at rest or in impending motion on a horizontal surface. Calculation of limiting friction, angle of friction, coefficient of friction. Conditions for sliding versus tipping.	LC, SC
		3.5	Equilibrium of bodies on inclined plane	Resolution of forces on an inclined plane (parallel and perpendicular components). Conditions for a body to slide down, remain at rest, or be on the point of motion on an incline. Role of friction on inclined surfaces. Practical examples (eg, ramps, wedge problems).	LC, SC
Section 4	Simple Lifting Machine	4.1	Definitions of simple machine	Definition of a simple lifting machine as a mechanical device used to overcome a larger load (resistance) by applying a smaller effort. Core terminology: effort (applied force), load (weight to be lifted), mechanical advantage, velocity ratio, input work, output work, efficiency.	LC, SC
		4.2	Law of machine, maximum mechanical advantage	The law of machine as a linear relationship between effort and load. Graphical representation (effort vs. load plot). Determination of maximum mechanical advantage and limiting efficiency. Reversibility and self-locking (non-reversible) machines. Conditions for maximum efficiency.	LC, SC
		4.3	Study of simple machines	Detailed analysis of common lifting machines: lever systems (first, second, and third order), pulley systems (single fixed, single movable, block and tackle), screw jack, wheel and axle, inclined plane as a lifting machine. Calculation of mechanical advantage, velocity	LC, SC

Section number	Name of the discipline section	Topic Title		Topic Contents	Type of academic work*
				ratio, and efficiency for each type. Practical applications and comparative evaluation.	

* - to be completed 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 for the discipline

Audience type	Equipment of the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	A lecture hall equipped with specialized furniture, a whiteboard (screen), and multimedia presentation equipment.	
Computer class	A computer room for conducting classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with personal computers (15 in total), a board (screen) and technical means for multimedia presentations.	
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with a set of specialized furniture and technical means for multimedia presentations.	
For independent work	A classroom for independent student work (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information System.	

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

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

Main literature:

1. “Vector Mechanics for Engineers: Statics and Dynamics,” by Beer, Johnston, and Eisenberg, McGraw-Hill, 10th Edition.

2. “Materials Science and Engineering”, William D. Callister Jr. and David G. Rethwisch, 9th ed., SI Version, John Wiley & Sons, 2014

3. “Shigley's Mechanical Engineering Design”, Richard G Budynas and Keith J Nisbett, 10th ed., McGraw-Hill Higher Education, 2014

Further reading:

1. “Elasticity”, James R. Barber, 3rd ed., Dordrecht: Springer Netherlands, 2010.On-line version available through CityU library.

2. “Mechanics of materials,” Barry J. Goodno and James M. Gere, 9th ed., SI Version, Cengage Learning, 2018.

Resources of the information and telecommunications network "Internet":

1. RUDN University Electronic Library System and third-party electronic library systems to which university students have access based on concluded agreements

- RUDN University Electronic Library System – RUDN University Electronic Library System https://mega.rudn.ru/MegaPro/Web

- Electronic Library System "University Library Online" http://www.biblioclub.ru
- EBS Yurayt http://www.biblio-online.ru
- Electronic Library System "Student Consultant" www.studentlibrary.ru
- EBS “Knowledge” https://znanium.ru/

2. Databases and search engines
   - Sage https://journals.sagepub.com/
   - Springer Nature Link https://link.springer.com/
   - Wiley Journal Database https://onlinelibrary.wiley.com/
   - Scientometric database Lens.org https://www.lens.org

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

1. Lecture course on the subject "Applied Statistics".

* - all teaching 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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