

Документ подписан простой электронной подписью  
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**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**

### **INFERENTIAL STATISTICS**

(name of discipline/module)

**Recommended for the field of study/specialty:**

### **27.04.04 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):**

**AIML and Space Sciences / Artificial Intelligence, Machine Learning and Space  
Sciences**

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

## 1. THE GOAL OF MASTERING THE DISCIPLINE

The discipline "Inferential Statistics " is included in the master's program "Artificial Intelligence, Machine Learning and Space Sciences" in the direction 27.04.04 "Control in Technical Systems" and is studied in the 2nd semester of the 1st year. The discipline is implemented by the Department of the Partner University. The discipline consists of 5 sections and 10 topics and is aimed at studying the rules for formalizing problems through logical calculations, tools for developing statistical criteria based on logical schemes.

The purpose of mastering the discipline is to develop skills in synthesizing logical methods and statistical analysis, develop skills in constructing formal models for testing hypotheses, and prepare for the application of logical and statistical tools in Data Science.

## 2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Inferential Statistics" 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)
GPC-4	Capable of assessing the effectiveness of the results of developing control systems using mathematical methods	GPC-4.1 Knows the basic mathematical methods used to evaluate the effectiveness of the results of control systems; GPC-4.2 Able to apply mathematical methods to evaluate the effectiveness of the results of control systems; GPC-4.3 Proficient in methods for assessing the effectiveness of management systems;
GPC-6	Capable of collecting and analyzing scientific and technical information, generalizing domestic and foreign experience in the field of automation and control equipment	GPC-6.1 Knows the basic methods of collecting and analyzing scientific and technical information; GPC-6.2 Able to analyze and generalize domestic and foreign experience in the field of automation and control equipment; GPC-6.3 Has knowledge of methods for collecting and analyzing scientific and technical information, and can also generalize domestic and foreign experience in the professional field;

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

Discipline " Inferential 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 "Inferential 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, practices*	Subsequent disciplines/modules, practices*
GPC-6	Capable of collecting and analyzing scientific and technical information, generalizing domestic and	Relational Database Management System; Python for Data Science;	Undergraduate practice / Pre-graduation practice; Research Work;

<b>Cipher</b>	<b>Name of competence</b>	<b>Previous courses/modules, practices*</b>	<b>Subsequent disciplines/modules, practices*</b>
	foreign experience in the field of automation and control equipment		Technology Threats and Cybersecurity Systems;
GPC-4	Capable of assessing the effectiveness of the results of developing control systems using mathematical methods		Undergraduate practice / Pre-graduation practice;

\* - 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 discipline "Inferential Statistics" is "3" 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,ac.h.		Semester(s)
			2
<i>Contact work, academic hours</i>	34		34
Lectures (LC)	17		17
Laboratory work (LW)	17		17
Practical/seminar classes (SC)	0		0
<i>Independent work of students, academic hours</i>	74		74
<i>Control (exam/test with assessment), academic hours</i>	0		0
<b>General complexity of the discipline</b>	<b>ac.h.</b>	<b>108</b>	<b>108</b>
	<b>credit.ed.</b>	<b>3</b>	<b>3</b>

## 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	Types and kinds of statistical data.	1.1	Types of statistical data. Quantitative (discrete and continuous) variables. Qualitative (nominal and ordinal) variables. Types of statistical data analysis. Primary and secondary analysis. Descriptive statistics. Descriptive statistics indicators. Criteria for testing the hypothesis about the distribution law.	LC, LW
		1.2	Types of feature distributions. Parametric and nonparametric principles of statistical processing. Normal and abnormal distribution. Mode. Median. Arithmetic mean. Standard deviation. Standard error of the mean. Distribution width. Confidence interval. Quantiles. Number of objects as a characteristic of qualitative data.	LC, LW
Section 2	Selecting comparison criteria.	2.1	Tasks and areas of application of inductive statistics. Statistical hypotheses. Statistical significance. Error of the first kind. Error of the second kind.	LC, LW
		2.2	Assumption of feature bias. One-sided tests. Two-sided tests. Dependent and independent samples. Statistical criteria. Methodology of inductive statistical processing of research. Nonparametric methods	LC, LW
Section 3	Risk and threshold analysis using a contingency table.	3.1	Contingency table. Rules for filling in the contingency table. $\chi^2$ criterion. Yates correction.	LC, LW
		3.2	Use of a contingency table to calculate values of risk, chance, risk-odds ratio, absolute and relative risk increase or decrease, index of potential benefit or harm, sensitivity, specificity, positive and negative predictive value, and likelihood ratio.	LC, LW
		3.3	Fisher's exact test.	LC, LW
Section 4	Research of dependencies.	4.1	Statistical methods for finding relationships between variables. Correlation analysis. Pearson's linear correlation coefficient. Spearman's rank correlation coefficient.	LC, LW
		4.2	Regression analysis. Binary logistic regression, capabilities of the method. Probability of occurrence of a binary event. Assessment of adequacy of the binary logistic regression model. Multinomial logistic regression. Cox regression, or proportional hazards model. Risk of occurrence of an event	LC, LW
Section 5	Dimensionality reduction.	5.1	Dimensionality reduction. Factor analysis, the purpose of factor analysis. The procedure for extracting principal components. Scatterplot of the studied variables. Kaiser criterion. Scree criterion. Component matrix. Vector loadings of variables.	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*

<b>Audience type</b>	<b>Equipping the auditorium</b>	<b>Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)</b>
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 (in the amount of [Parameter] pcs.), a board (screen) and technical means for multimedia presentations.	
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. Matthews S. Review of Statistical Learning for Big, Dependent Data. – 2024.
2. Das S. Causal Inference in R: Decipher complex relationships with advanced R techniques for data-driven decision-making. – Packt Publishing Ltd, 2024.

### *Further reading:*

1. Cheung LC Probability Modeling and Statistical Inference in Cancer Screening. – 2024.
2. Sahu PK, Pal SR, Das AK Estimation and inferential statistics. –NewDelhi: Springer, 2015. – pp. 1-317.

### *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 RUDN  
<https://mega.rudn.ru/MegaPro/Web>
  - Electronic library system "University library online"<http://www.biblioclub.ru>
  - EBS Yurait<http://www.biblio-online.ru>
  - Electronic Library System "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)
  - EBS "Znanium"<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 "Inductive statistics".

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

**DEVELOPER:**

Associate Professor		Saltykova Olga Alexandrovna
<i>Position, Department</i>	<i>Signature</i>	<i>Surname I.O.</i>

**HEAD OF THE  
DEPARTMENT:**

<i>Position of the Department</i>	<i>Signature</i>	<i>Surname I.O.</i>

**HEAD OF THE EP HE:**

Head of Department		Razumny Yuri Nikolaevich
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