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

Python for Data Science
(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)

2025

1. THE GOAL OF MASTERING THE DISCIPLINE

The discipline "Python for Data Science" is part of 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 1st semester of the 1st year. The discipline is implemented by the Department of the Partner University. The discipline consists of 4 sections and 11 topics and is aimed at studying - features of the Python language for data analysis, principles of reading various data; - Python libraries containing a large number of tools: from fast operations with multidimensional arrays to visualization and implementation of various mathematical methods, including linear algebra as the main mathematical apparatus for working with data; - optimization methods as the best tool for determining the optimal parameters of the system; - matrix decompositions, which are used in constructing regression models to reduce the dimensionality of data, in recommender systems and in text analysis; - basic concepts of probability theory and statistics, which are necessary for understanding the mechanism of operation of almost all data analysis methods.

The purpose of mastering the discipline is to become familiar with the basics of working with the Python language in data analysis, expanding theoretical and practical training in the field of mathematical analysis, linear algebra, optimization methods, and probability theory.

2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Python for Data Science" 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-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;
GPC-8	Able to select methods and develop control systems for complex technical objects and technological processes	GPC-8.1 Knows the basic methods used to develop control systems for complex technical objects and technological processes; GPC-8.2 Can develop control systems for complex technical objects and technological processes; GPC-8.3 Has skills in selecting methods and developing control systems for complex technical objects and technological processes;

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

Discipline "Python for Data Science" 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 "Python for Data Science".

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 foreign experience in the field of automation and control equipment		Technology Threats and Cybersecurity Systems; Inferential Statistics; Research work / Research work (acquiring primary skills in research work); Undergraduate practice / Pre-graduation practice; Research Work;
GPC-8	Able to select methods and develop control systems for complex technical objects and technological processes		Undergraduate practice / Pre-graduation practice; Blockchain Technology;

* - 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 “Python for Data Science” course is 4 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)**
			1
Contact work, academic hours	*34*		*34*
Lectures (LC)	17		17
Laboratory work (LW)	17		17
Practical/seminar classes (SC)	0		0
Independent work of students, academic hours	*74*		*74*
Control (exam/test with assessment), academic hours	*36*		*36*
General complexity of the discipline	**ac.h.**	***144***	*144*
	credit.ed.	***4***	*4*

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	Introduction	1.1	Cycles, functions, generators, list comprehension.	LC, LW
		1.2	Functions and their properties. Limit and derivative.	LC, LW
		1.3	Geometrical meaning of the derivative.	LC, LW
Section 2	Python Libraries and Linear Algebra	2.1	Pandas. Data Frame. NumPy, SciPy and Matplotlib.	LC, LW
		2.2	Solving optimization problems in SciPy.	LC, LW
		2.3	Systems of linear equations. Matrix operations. Rank and determinant	LC, LW
Section 3	Optimization and matrix factorizations	3.1	Partial derivatives and gradient. Tangent plane and linear approximation.	LC, LW
		3.2	Optimization of non-smooth functions. Simulated annealing method.	LC, LW
		3.3	Genetic Algorithms and Differential Evolution. Nelder-Mead. Approximation by a Matrix of Lower Rank.	LC, LW
Section 4	Accident	4.1	Randomness in probability theory and statistics. Properties of probability.	LC, LW
		4.2	Conditional Probability. Estimating Distributions from a Sample. Important Characteristics of Distributions. Central Limit Theorem. Confidence Intervals	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.	
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. Muddana AL, Vinayakam S. Python for Data Science. – Springer, 2024. – P. 1-378.
2. Chevallier A. et al. Python for datascience: dis. – Trivedi Center for Political Data (TCPD) Ashoka University, 2017.

Further reading:

1. Python W. Python //Python releases for windows. – 2021. – T. 24.
2. Van Rossum G., Drake FL An introduction to Python. –Bristol: Network Theory Ltd., 2003. – P. 115.

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
   - 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 "Python for Data Science".

* - 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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