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

PROGRAMMING TECHNOLOGY
(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 Programming Technology course is part of the Master's program Artificial Intelligence, Machine Learning and Space Sciences in the direction 27.04.04 Management in Technical Systems and is studied in the 1st semester of the 1st year. The course is implemented by the Department of Mechanics and Control Processes. The course consists of 7 sections and 19 topics and is aimed at studying basic sorting and search algorithms, graph algorithms, dynamic programming methods, modern programming paradigms, approaches to parallel and distributed programming technologies.

The goal of mastering the discipline is for students to acquire practical skills in algorithmization and programming.

2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Programming Technolog" 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-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 Has command of 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 achievements of 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 Has mastered methods for 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 EDUCATION

Discipline "Programming Technology" 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 "Programming Technology".

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-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		Advanced Methods of Space Flight Mechanics; Advanced Methods of Earth Remote Sensing; Geoinformation Systems and Applications; Undergraduate Training;
GPC-2	Able to formulate control problems in technical systems and justify methods for solving them		Undergraduate Training; Dynamics and Control of Space Systems;
GPC-3	Capable of independently solving control problems in technical systems based on the latest achievements of science and technology		Dynamics and Control of Space Systems; Advanced Methods of Space Flight Mechanics; Research work / Scientific research work; 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 "Programming Technology" discipline is 8 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)**
			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	*218*		*218*
Control (exam/test with assessment), academic hours	*36*		*36*
General complexity of the discipline	**ac.h.**	***288***	*288*
	credit.ed.	***8***	*8*

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	Basic concepts of programming technology, features of a software project. Ways to overcome difficulties during development.	1.1	The concept of programming technology: Features of industrial programming, "programming for yourself" (Just for fun) and "programming to order".	LC, LW
		1.2	Programming languages as a means of expressing algorithms and as a means of obtaining executable code	LC, LW
		1.3	Memory allocation in C language. Software life cycle. General project organization	LC, LW
Section 2	The importance of the subject area. Various models of the software development process. ADTs oriented to the subject area, project feasibility assessment, execution schedules.	2.1	The importance of the subject area. Cascade and spiral models of the software development process. The emergence and exploration of the idea.	LC, LW
		2.2	Illustrations on the previous example of ADT, feasibility assessment: How to assess the complexity of a task?	LC, LW
		2.3	The feasibility of its solution within the specified timeframes under the specified framework constraints. Planning: Network and tape schedules, triangle - deadlines, work, resources. Analysis of requirements and development of software specifications. Design of product architecture.	LC, LW
Section 3	Testing, Quality Assurance: Quality criteria and their metrics. Static and dynamic testing. White and black box methods. Creation of test data sets.	3.1	Testing, quality assurance: Quality criteria and their metrics. ISO 9000, 9001 standards. Information technology standardization. Static and dynamic testing.	LC, LW
		3.2	White and Black Box Methods: Creating Test Datasets	LC, LW
		3.3	Examples from a specific subject area. Group development (problem setting)	LC, LW
Section 4	Automation tools for developing parsers. Concepts of language grammar, lexical and syntactic parsing. yacc, bison recognizer generators. Linguistic approach to developing applications.	4.1	Automation tools for solving traditionally difficult problems. Development of syntactic analyzers.	LC, LW
		4.2	Concepts of language grammar, lexical and syntactic analysis. Methods of describing grammar	LC, LW
		4.3	BNF notation, yacc, bison recognizer generator. Linguistic approach to application development	LC, LW
Section 5	Group development, version control. Parallel and competitive development. Different ways of organizing a team of developers. Main and auxiliary departments in the enterprise and their tasks	5.1	Group development, version control. Single project repository. RCS, CVS systems.	LC, LW
		5.2	Version numbering methods. Parallel and competitive development. Organization of the development team: Matrix method, chief specialist method, vertical and horizontal project management coordination	LC, LW
		5.3	Main and auxiliary units and their tasks.	LC, LW
Section 6	Accompaniment	6.1	Maintenance: Bug fixes, additional functionality, efficiency improvements	LC, LW
		6.2	Requirements for software and documentation to implement successful support	LC, LW
Section 7	User interface development: tasks to be solved and tools.	7.1	User interface development: tasks and tools to be solved. Appropriateness and metaphorical nature of the interface. Types of interfaces. Tools for interface development.	LC, LW

Section number	Name of the discipline section	Section Contents (Topics)		Type of academic work*
		7.2	Software systems reengineering: Translation of legacy programs into new languages and platforms, reverse engineering - extracting knowledge from program text	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 (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.Python 3. The Essentials. Prokhorenok N., Dronov V., BHV-Petersburg, 2019 – 610 p.;

2. Algorithms. Handbook with examples in C,C++, Java and Python. Heinemann J., Pollis G., SeLCov S., St. Petersburg: OOO Alfa-kniga, 2017 – 432 p.;

Further reading:

1. Automate old tasks withPython: A Practical Guide for Beginners. Sveyart El., M.: "ID Williams", 2017 - 592 p.

2. Programming languageC. Lectures and exercises. S. Prata, M.: Williams Publishing House, 2013 – 960 p.;

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 Yuraithttp://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. A course of lectures on the subject "Programming Technologies".

* - 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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