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

Academy of Engineering

(name of the main educational unit (MEU) – developer of the educational program of higher education)

INTERNSHIP PROGRAM

Research work / Research work

(name of practice)

Industrial practice

(type of practice: educational, industrial)

Recommended by the ICSC for the field of study/specialty:

27.04.04 "Control in Technical Systems"

(code and name of the training area/specialty)

Practical training of students is carried out within the framework of the implementation of the main professional educational program of higher education (EP HE):

AIML and Space Science / Artificial Intelligence, Machine Learning and Space Science

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

2025

1. PURPOSE OF THE INTERNSHIP

The purpose of Research work / Scientific research work is to master the skills of independent scientific research work on collecting, processing scientific and technical materials based on the results of research on the topic of the master's thesis and submitting them for publication in the form of scientific and technical articles, reviews, abstracts, reports, papers and lectures. These materials should be used to form the topic of the student's master's thesis.

The main tasks of Research work / Research work are:

- organization and planningeducational activities;
- collection, processing, analysis and systematization of scientific and technical information of world level, including in foreign languages;
- selection of methods and means for solving problems on the research topic;
- gaining experience in using standard professional software products aimed at solving design, technological and scientific problems;
- development of plans and programs for innovative activities in the division;
- gaining experience in active interaction with colleagues in the scientific field of activity;
- preparation of scientific and technical reports, reviews, publications, scientific papers, applications for inventions, the text of a master's thesis and other materials based on the results of completed research.

2. REQUIREMENTS FOR THE RESULTS OF TRAINING BASED ON THE RESULTS OF THE INTERNSHIP

Conducting Research work / Research work is aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies developed in students during internship (learning outcomes based on internship results)

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
UC-7	The ability to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	UC-7.1. Knows the basic digital technologies, methods of searching, processing, analyzing, storing and presenting information used in the modern conditions of the digital economy;
		UC-7.2. Able to apply modern digital technologies to solve problems of professional activity in the conditions of the digital economy;
		UC-7.3. Has a command of modern digital technologies, methods of searching, processing, analyzing, storing and presenting information (in the field of control in technical systems) in the context of the digital economy and modern corporate information culture.
GPC-5	Ability to conduct patent research, determine forms and methods of legal protection and defense of rights to the results	GPC-5.1. Knows the methods and approaches to conducting patent research, forms and methods of legal protection and defense of rights to the results of intellectual activity;

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
	of intellectual activity, manage rights to them to solve problems in the development of science, technology and engineering	GPC-5.2. Able to manage rights to the results of intellectual activity to solve problems in the field of development of science, engineering and technology;
		GPC-5.3. Has knowledge of methods and approaches to conducting patent research, knows methods of legal protection and defense of rights to the results of intellectual activity.
GPC-6	Ability to collect and analyze scientific and technical information, summarize 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-10	Capable of managing the development of methodological and regulatory documents, technical documentation in the field of automation of technological processes and production, including on the life cycle of products and their quality	GPC-10.1 Familiar with the main approaches to the development of methodological and regulatory documents, technical documentation in the field of automation of technological processes and production;
		GPC-10.2 Has knowledge of approaches to managing the development of technical documentation and regulatory documents in the field of automation of technological processes and production, including the life cycle of products and their quality.
PC-2	Ability to apply modern theoretical and experimental methods for developing mathematical models of objects and processes under study related to professional activities in the field of training	PC-2.1. Knows modern theoretical and experimental methods used to develop mathematical models of the objects under study and processes of professional activity;
		PC-2.2. Able to determine the effectiveness of the methods used to develop mathematical models of the objects and processes under study;
		PC-2.3. Has mastered modern theoretical and experimental methods for developing mathematical models of objects in the field of application of geographic information systems in territorial development.
PC-4	Capable of participating in scientific research and development of design solutions in the field of ballistics, dynamics and flight control of spacecraft	PC-4.1 Familiar with the basic methods and approaches used to solve problems in the field of artificial intelligence and robotic systems;
		PC-4.2 Has knowledge of methods for solving professional problems in the field of artificial intelligence and robotic systems;
		PC-4.3 Able to apply mathematical methods and modern information technologies when conducting scientific research.

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

Research work / Research work refers to the optional component of the compulsory part of Block 2 Practice of the curriculum.

As part of the EP VO, students also master disciplines and/or other practices that contribute to the achievement of planned learning outcomes upon completion of Research work.

Table 3.1. List of components of the educational program of higher education that contribute to the achievement of planned learning outcomes following the completion of the internship

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
UC-7	The ability to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	History and Methodology of Science / History and methodology of science Research work / Research work (acquiring basic skills in research work)	Undergraduate Training / Pre-graduation Internship State final certification
GPC-5	Ability to conduct patent research, determine forms and methods of legal protection and defense of rights to the results of intellectual activity, manage rights to them to solve problems in the development of science, technology and engineering	Relational Database Management System / Relational Database Management System Research work / Research work (acquiring basic skills in research work)	Undergraduate Training / Pre-graduation Internship State final certification
GPC-6	Ability to collect and analyze scientific and technical information, summarize domestic and foreign experience in the field of automation and control equipment	Relational Database Management System / Relational Database Management System; Inferential Statistics / Inductive Statistics; Python for Data Science / Python for Data Science; Technology Threats and Cybersecurity Systems / Technology Threats and Cybersecurity Systems Research work / Research work (acquiring basic skills in research work)	Undergraduate Training / Pre-graduation Internship State final certification
GPC-10	Capable of managing the development of methodological and regulatory documents, technical documentation in the field of automation of technological processes and	Advanced Methods of Space Flight Mechanics / Modern methods of space flight mechanics;	Undergraduate Training / Pre-graduation Internship State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
	production, including on the life cycle of products and their quality	Technology Threats and Cybersecurity Systems / Technology Threats and Cybersecurity Systems Research work / Research work (acquiring basic skills in research work)	
PC-2	Ability to apply modern theoretical and experimental methods for developing mathematical models of objects and processes under study related to professional activities in the field of training	Mathematics for Spatial Sciences / Spatial Mathematics; Operations Research and Optimization Techniques / Methods of operations research and optimization; Advanced Methods of Space Flight Mechanics / Modern methods of space flight mechanics; Dynamics and Control of Space Systems / Dynamics and Control of Space Systems; Artificial Neural Networks (Deep Learning) Artificial Neural Networks (Deep Learning) Artificial Neural Networks (Reinforcement Learning) Research work / Research work (acquiring basic skills in research work)	Undergraduate Training / Pre-graduation Internship State final certification
PC-4	Capable of participating in scientific research and development of design solutions in the field of ballistics, dynamics and flight control of spacecraft	Artificial Intelligence / Artificial Intelligence; Dynamics and Control of Space Systems / Dynamics	Undergraduate Training / Pre-graduation Internship State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
		and Control of Space Systems; Artificial Neural Networks (Reinforcement Learning) Research work / Research work (acquiring basic skills in research work)	

* - filled in in accordance with the competency matrix and the SUP EP HE

4. SCOPE OF THE INTERNSHIP

The total workload of the research work is 3 credit units (108 academic hours).

5. CONTENT OF THE INTERNSHIP

Table 5.1. Contents of practice*

Name of the practice section	Section content (topics, types of practical activities)	Labor intensity,ac.h.
Section 1. Organizational and preparatory	Receiving an individual assignment for practice from the supervisor	2
	Safety training at the workplace (in the laboratory and/or in production)	2
Section 2. Main	Collection of analytical data in accordance with individual assignment. Description of application processes and software.	40
	Analysis and processing of the received data	20
	Research and publication work	10
	Ongoing monitoring of the internship by the supervisor	10
	Keeping a diary of your internship	4
Preparation of the internship report		10
Preparation for defense and defense of the internship report		10
	TOTAL:	108

* - the content of the practice by sections and types of practical training is FULLY reflected in the student's practice report.

6. MATERIALLY-TECHNICAL SUPPORT FOR THE INTERNSHIP

The scientific and educational laboratories of the Department of Mechanics and Control Processes, the premises of partner enterprises where students undergo practical training, are equipped with a local network with Internet access, a projector and an interactive whiteboard.

7. METHOD OF CONDUCTING PRACTICE

Research work / Research work can be carried out both in RUDN structural divisions or in Moscow organizations (stationary), and at bases located outside Moscow (visiting).

Conducting an internship at an external organization (outside RUDN) is carried out on the basis of a relevant agreement, which specifies the terms, place and conditions for conducting the internship at the base organization.

The internship dates correspond to the period specified in the academic calendar of the EP VO. The internship dates may be adjusted upon agreement with the Educational Policy Department and the Department for the Organization of Internships and Assistance to Graduates' Employment at RUDN.

8. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT FOR PRACTICE

Main literature:
– Classical and modern methods of automatic control theory. Textbook in 5 volumes; 2nd edition, revised and enlarged / Ed. by K.A. Pupkov, N.D. Egupov. – Moscow: Publishing House of Bauman Moscow State Technical University, 2004.
– Pupkov K.A. Modeling and testing of automatic control systems. Tutorial. – M.: RUDN, 2014. – 98s.
– Egoupov N.D., Kolesnikov L.V., Pupkov K.A., Trofimov A.I. / edited by Matveev V.A. Algorithmic theory of control systems based on spectral methods. Monograph in 2 volumes. – Moscow: Publishing house of Bauman Moscow State Technical University, 2014. – 464 pages. Volume 1 and – 464 pages. Volume 2.

Further reading:
Domestic journals: Automation and Remote Control; Sensors and Systems; News of Higher Educational Institutions. Instrument Making; News of Higher Educational Institutions. Applied Nonlinear Dynamics; News of Higher Educational Institutions. Power Engineering Problems; News of the Russian Academy of Sciences. Control Theory and Systems; Information Measuring and Control Systems; Information Technology; Mathematical Modeling; Mechatronics. Automation. Control; Nonlinear World; Review of Applied and Industrial Mathematics; Devices and Systems: "Control, Monitoring, Diagnostics"; Applied Mathematics and Mechanics; Forecasting Problems; Problems of Control Theory and Practice; Control Problems; Control Systems and Information Technology; Digital Signal Processing; Open Systems; Neurocomputers: Development, Application.
Foreign journals: CAD/CAM/CAE Observer; Artificial Intelligence; IEEE Transaction on Automation Control; Control; IEEE Mechanical.

Resources of the information and telecommunications network "Internet":
1) Electronic library system (ELS) of RUDN and third-party ELS, to which the university students have access on the basis of concluded agreements:
– EBS RUDN http://lib.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 "Lan" http://e.lanbook.com/
– EBS "Troitsky Bridge"
2) Databases and search engines:
– electronic fund of legal and normative-technical documentation http://docs.cntd.ru/
– Yandex search engine https://www.yandex.ru/
– Google search engine https://www.google.ru/
– SCOPUS abstract database http://www.elsevierscience.ru/products/scopus/

Educational-methodological materials for completing the internship, filling out the diary and preparing the internship report*:

1)   Rules for safe working conditions and fire safety during Research work / Research work (initial briefing).

2)   General structure and operating principle of technological production equipment used by students during their internship; process maps and regulations, etc. (if necessary).

3)   Methodological instructions for students to fill out a diary and prepare a practice report.

* - all educational and methodological materials for completing the internship are posted in accordance with the current procedure on the internship page in TUIS

9. EVALUATIONMATERIALS AND SCORE-RATING SYSTEM FOR ASSESSING THE LEVEL OF COMPETENCE DEVELOPMENT BASED ON THE RESULTS OF PRACTICE

Assessment materials and a scoring and rating system* for assessing the level of development of competencies (part of competencies) based on the results of passingResearch work / Research work is presented in the Appendix to this Internship Program (module).

* - OM and BRS are formed on the basis of the requirements of the relevant local regulatory act of RUDN (regulations/procedures).

DEVELOPERS:

Associate Professor of the Department of Mechanics and Control Processes		Saltykova O.A.
Position, Department	Signature	Surname I.O.

HEAD OF THE DEPARTMENT:

Head of the Department of Mechanics and Control Processes		Razumny Yu.N.
Name of the Department	Signature	Surname I.O.

HEAD OF THE EP HE:

Head of the Department of Mechanics and Control Processes		Razumny Yu.N
Position, Department	Signature	Surname I.O.