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**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

Pre-graduation practice

(name of practice)

Industrial practice

(type of practice: educational, industrial)

Recommended for the field of study/specialty:

27.03.04 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):**

Data Science and Space Systems / Data Science and Space Systems

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

1. PURPOSE OF THE INTERNSHIP

Pre-graduation practice is an industrial practice and is aimed at deepening, systematizing and consolidating theoretical knowledge, as well as the final formation of professional skills and abilities in the field of conducting scientific research in solving practical problems in the field of control in technical systems, mathematical and computer modeling of complex technical objects and systems, the use of modern programming technologies, the development of special software and mathematical support for managing complex technical objects and systems in the interests of general mechanical engineering, aerospace and other science-intensive industries. Students collect, process and analyze the material necessary for the development of the final qualifying work, they acquire teamwork skills and communication skills necessary when developing large projects, and also form and develop practical skills and gain experience in independent professional activity in the field of information technology in management and in the field of cybersecurity of information systems.

2. REQUIREMENTS TO LEARNING RESULTS AFTER COMPLETING PRACTICE

The pre-graduation practice 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-1	Able to search, critically analyze and synthesize information, and apply a systematic approach to solving assigned tasks.	UC-1.1. Analyzes the task, identifying its basic components; UC-1.2. Defines and ranks the information required to solve the assigned task; UC-1.3. Conducts a search for information to solve the assigned task using various types of requests; UC-1.4. Works with scientific texts, distinguishes facts from opinions, interpretations, assessments and substantiates his conclusions using the philosophical conceptual apparatus; UC-1.5. Analyzes and contextually processes information to solve assigned tasks while forming their own opinions and judgments; UC-1.6. Suggests options for solving the problem, analyzes the possible consequences of their use; UC-1.7. Analyzes ways of solving problems of worldview, moral and personal character based on the use of basic philosophical ideas and categories in their historical development and socio-cultural context.
UC-2	Able to define a range of tasks within the framework of a set goal and select optimal ways to solve them, based on current legal regulations, available resources and limitations	UC-2.1. Formulates a problem, the solution of which is directly related to achieving the project goal; UC-2.2. Defines the connections between the tasks set and the expected results of their solution; UC-2.3. Within the framework of the set tasks, determines the available resources and limitations, current legal norms; UC-2.4. Analyzes the project implementation schedule as a whole and selects the optimal way to solve the tasks set,

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
		based on current legal regulations and available resources and limitations; UC-2.5 Monitors the progress of the project, adjusts the schedule in accordance with the monitoring results.
UC-3	Able to interact socially and fulfill his/her role in a team	UC-3.1. Determines his/her role in the team based on the strategy of cooperation to achieve the set goal; UC-3.2. Formulates and takes into account in its activities the behavioral characteristics of groups of people, identified depending on the set goal; UC-3.3. Analyzes the possible consequences of personal actions and plans his actions to achieve a given result; UC-3.4. Carries out the exchange of information, knowledge and experience with team members; UC-3.5. Argues his point of view regarding the use of ideas of other team members to achieve the set goal; UC-3.6. Participates in teamwork to carry out assignments.
UC-4	Capable of interpersonal and intercultural communication interaction in Russian (as a foreign language) and foreign language(s) based on proficiency in interconnected and interdependent types of reproductive and productive foreign language speech activity, such as listening, speaking, reading, writing and translation in everyday, socio-cultural, educational and professional, official business and scientific areas of communication.	UC-4.1. Selects a style of business communication, depending on the language of communication, the purpose and conditions of the partnership; UC-4.2. Adapts speech, communication style and sign language to interaction situations; UC-4.3. Searches for the necessary information to solve standard communication tasks in Russian and foreign languages; UC-4.4. Performs translation of professional texts from a foreign language into Russian and vice versa; UC-4.5. Conducts business correspondence in Russian and foreign languages, taking into account the stylistic features of official and unofficial letters and socio-cultural differences in the format of correspondence; UC-4.6. Uses dialogue to collaborate in academic work. communication taking into account the personality of the interlocutors, their communicative-speech strategy and tactics, and the degree of formality of the situation; UC-4.7. Forms and argues his/her own assessment of the main ideas of the participants in the dialogue (discussion) in accordance with the needs of the joint activity.
UC-5	Able to perceive the intercultural diversity of society in socio-historical, ethical and philosophical contexts.	UC-5.1. Interprets the history of Russia in the context of world historical development; UC-5.2. Finds and uses information about the cultural characteristics and traditions of various social groups in social and professional communication; UC-5.3. Takes into account, in social and professional communication on a given topic, the historical heritage and socio-cultural traditions of various social groups, ethnic groups and faiths, including world religions, philosophical and ethical teachings UC-5.4. Collects information on a given topic, taking into account the ethnic groups and religions most widely represented at the research sites. UC-5.5 Substantiates the specifics of project and team activities with representatives of other ethnic groups and (or) faiths

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
		UC-5.6 Adheres to the principles of non-discriminatory interaction in personal and mass communication in order to fulfill professional tasks and strengthen social integration
UC-6	Able to manage their time, build and implement a trajectory of self-development based on the principles of lifelong education	<p>UC-6.1. Controls the amount of time spent on specific activities</p> <p>UC-6.2. Develops tools and methods for time management when performing specific tasks, projects, and goals</p> <p>UC-6.3. Analyzes his resources and their limits (personal, situational, temporary, etc.) for the successful completion of the assigned task.</p> <p>UC-6.4. Finds and uses sources of additional information to improve the level of general and professional knowledge</p> <p>UC-6.5. Analyzes the main opportunities and tools of continuous education in relation to their own interests and needs, taking into account the conditions, resources, personal capabilities, stages of career growth, time perspective of development of activities and requirements of the labor market</p> <p>UC-6.6. Defines the tasks of self-development, goals and priorities of professional growth</p> <p>UC-6.7. Distributes tasks into long-, medium- and short-term ones with justification of relevance and analysis of resources for their implementation</p>
UC-7	Able to maintain an adequate level of physical fitness to ensure full social and professional activity	<p>UC-7.1. Selects health-saving technologies to maintain a healthy lifestyle, taking into account the physiological characteristics of the body</p> <p>UC-7.2. Plans his/her working and free time for the optimal combination of physical and mental load and ensuring efficiency</p> <p>UC-7.3. Observes and promotes healthy lifestyle standards in various life situations and in professional activities"</p>
UC-8	Capable of creating and maintaining safe living conditions in everyday life and professional activities to preserve the natural environment, ensure sustainable development of society, including in the event of a threat or occurrence of emergency situations and military conflicts	<p>UC-8.1. Analyzes factors of harmful influence on the life activity of elements of the living environment (technical means, technological processes, materials, buildings and structures, natural and social phenomena)</p> <p>UC-8.2. Identifies hazardous and harmful factors within the framework of the task being performed</p> <p>UC-8.3. Identifies and eliminates problems related to safety violations in the workplace</p> <p>UC-8.4. Explains measures to prevent emergency situations</p> <p>UC-8.5. Explains the rules of conduct in the event of emergencies of natural and man-made origin, as well as in the event of military conflicts</p> <p>UC-8.6. Provides first aid, participates in recovery activities</p>
UC-9	Able to use basic defectological knowledge in social and professional spheres	<p>UC-9.1. Has an understanding of the principles of non-discriminatory interaction in communication in various spheres of life, taking into account the socio-psychological characteristics of persons with disabilities</p> <p>UC-9.2. Plans and carries out professional activities with persons with disabilities or limited health capabilities</p>

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
		UC-9.3. Interacts with persons with limited health capabilities or disabilities in the social and professional spheres
UC-10	Able to make informed economic decisions in various areas of life	UC-10.1. Understands the basic principles of the functioning of the economy and economic development, the goals of the form of state participation in the economy UC-10.2. Applies methods of personal economic and financial planning to achieve current and long-term financial goals UC-10.3. Uses financial instruments to manage personal finances (personal budget), controls own economic and financial risks
UC-11	Capable of forming an intolerant attitude towards manifestations of extremism, terrorism, corrupt behavior and counteracting them in professional activities	UC-11.1. Analyzes the current legal norms that ensure the fight against corruption in various areas of life, as well as methods of preventing corruption and forming an intolerant attitude towards it UC-11.2. Plans, organizes and conducts events that ensure the formation of a civic position and the prevention of corruption in society UC-11.3. Complies with the rules of public interaction based on compliance with current legislation and an intolerant attitude towards corruption
UC-12	Capable of: searching for the necessary sources of information and data, perceiving, analyzing, memorizing and transmitting information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information obtained to solve problems; evaluating information, its reliability, building logical conclusions based on incoming information and data	UC-12.1. Searches for the necessary sources of information and data, perceives, analyzes, remembers and transmits information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information obtained to solve problems UC-12.2. Conducts an assessment of information, its reliability, builds logical conclusions based on incoming information and data
GPC-1	Able to analyze the tasks of professional activity based on provisions, laws and methods in the field of natural sciences and mathematics	GPC-1.1 Knows the basic principles, laws and methods of natural sciences that can be applied to solve professional problems GPC-1.2 Identifies connections and patterns when solving problems related to professional activities GPC-1.3 Uses conclusions obtained on the basis of the fundamental laws and methods of natural sciences and mathematics within the framework of professional activities
GPC-2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and	GPC-2.1 Defines the tasks of professional activity from the perspective of specialized sections of mathematical and natural science disciplines GPC-2.2 Able to use knowledge of specialized

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
	natural science disciplines (modules)	sections of mathematical and natural science disciplines to formulate tasks of professional activity GPC-2.3 Applies knowledge of specialized sections of mathematical and natural science disciplines to develop an algorithm for solving problems of professional activity
GPC-3	Able to use fundamental knowledge to solve basic management problems in technical systems in order to improve in professional activities	GPC-3.1 Possesses fundamental knowledge to solve basic management problems in technical systems in order to improve in professional activities GPC-3.2 Applies fundamental knowledge to solve basic management problems in technical systems in order to improve professional performance GPC-3.3 Provides effective application of fundamental knowledge to solve management problems in technical systems for the purpose of improving professional activities
GPC-4	Capable of assessing the effectiveness of management systems developed on the basis of mathematical methods	GPC-4.1 Knows methods and approaches for assessing the effectiveness of management systems GPC-4.2 Able to apply known methods and approaches to assess the effectiveness of management systems GPC-4.3 Conducts an assessment of the effectiveness of management systems using methods developed on the basis of mathematical methods
GPC-5	Capable of solving problems of development of science, engineering and technology in the field of control in technical systems, taking into account legal regulation in the field of intellectual property	GPC-5.1 Defines goals for solving problems of development of science, engineering and technology in the field of control in technical systems GPC-5.2 Knows and uses methods to solve problems of development of science, engineering and technology in the field of control in technical systems, taking into account legal regulation in the field of intellectual property GPC-5.3 Provides solutions to problems of development of science, engineering and technology in the field of control in technical systems, taking into account legal regulation in the field of intellectual property
GPC-6	Capable of developing and using algorithms and programs, modern information technologies, methods and means of control, diagnostics and management, suitable for practical application in the field of his professional activity	GPC-6.1 Knows the basic algorithms and programs, modern information technologies, methods and means of control, diagnostics and management, suitable for practical application in the field of his professional activity GPC-6.2 Able to apply algorithms and programs, modern information technologies, methods and means of control, diagnostics and management, suitable for practical application in the field of his professional activity GPC-6.3 Confidently uses algorithms and programs, modern information technologies, methods and means of control, diagnostics and management, suitable for practical application in the field of their professional activity
GPC-7	Capable of making the necessary calculations of individual units and devices	GPC-7.1 Knows the procedure for making the necessary calculations for individual blocks and devices of control, automation and management systems, and

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
	of control, automation and management systems, selecting standard automation, measuring and computing equipment when designing automation and management systems	selects standard automation, measuring and computing equipment whendesign of automation and control systems GPC-7.2 Able to perform the necessary calculations of individual units and devices of control, automation and management systems, select standard automation, measuring and computing equipment when designing automation and management systems GPC-7.3 Proficient in technologies for performing calculations of individual units and devices of control, automation and management systems, selecting standard automation, measuring and computing equipment when designing automation and management systems
GPC-8	Capable of adjusting measuring and control equipment and systems, and performing their routine maintenance	GPC-8.1 Knows the parameters and characteristics of measuring and control equipment and complexes GPC-8.2 Able to perform routine maintenance of measuring and control equipment and complexes GPC-8.3 Provides adjustment of measuring and control equipment and complexes and their routine maintenance
GPC-9	Able to perform experiments using specified methods and process the results using modern information technologies and technical means.	GPC-9.1 Knows modern information technologies and technical means GPC-9.2 Able to apply modern information technologies and technical means to process experimental resultsntov GPC-9.3 Has mastered modern information technologies and technical means for performing experiments and processing results
GPC-10	Capable of developing (based on current standards) technical documentation (including in electronic form) for routine maintenance of control, automation and management systems and equipment	GPC-10.1 Knows current standards for developing technical documentation for routine maintenance of control, automation and management systems and equipment GPC-10.2 Knows the basic approaches to developing technical documentation (including in electronic form) for routine maintenance of control, automation and management systems and equipment GPC-10.3 Possesses skills in developing (based on current standards) technical documentation (including in electronic form) for routine maintenance of control, automation and management systems and equipment
GPC-11	Able to understand the principles of operation of modern information technologies and use them to solve problems of professional activity	GPC-11.1 Knows digital methods and technologies used in professional activities GPC-11.2 Able to apply digital methods and technologies in professional activities to study and model objects of professional activity, analyze data, and present information GPC-11.3 Confidently uses digital methods and technologies in professional activities (inareas of control in technical systems) for: studying and modeling objects of professional activity, data analysis, information presentation
PC-1	Capable of collecting, processing and interpreting modern scientific research	PC-1.1 Knows modern methods of collecting, processing and interpreting modern scientific research data necessary to form conclusions on relevant scientific

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
	data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	research PC-1.2 Able to apply modern methods and tools for processing and interpreting scientific research data PC-1.3 Possesses the basic skills of collecting, processing and interpreting modern scientific research data necessary for drawing conclusions on relevant scientific research
PC-2	Capable of participating in the development of schematic documentation for the flight control system of launch vehicles and spacecraft, in the preparation of publications based on the results of research and development	PC-2.1 Knows the basic approaches to developing mathematical models of units, functional modules and devices for flight control systems of launch vehicles and spacecraft PC-2.2 Able to compile analytical reviews and scientific and technical reports based on the results of research and development PC-2.3 Has skills in designing functional units and blocks of flight control systems for launch vehicles and spacecraft
PC-3	Capable of carrying out work on processing and analyzing information in the field of application of mathematical methods and information technologies in the field of application of remote sensing data of the Earth from space	PC-3.1 Knows the basic concepts in the field of application of mathematical methods and information technologies and application of remote sensing space systems PC-3.2 Able to solve analytical problems that offer a choice from a variety of relevant methods for solving problems, has skills in working with geographic information systems software packages PC-3.3 Possesses practical skills in solving problems related to obtaining, processing and applying remote sensing data of the Earth from space
PC-4	Able to formulate, analyze and solve engineering problems in the field of ballistics, motion mechanics and spacecraft motion control based on professional knowledge	PC-4.1 Knows the basic concepts and basic algorithms for solving problems in the field of ballistics, motion mechanics and motion control based on automated and automatic systems PC-4.2 Able to solve engineering problems of an analytical nature in the field of ballistics, motion mechanics and control of spacecraft motion based on professional knowledge PC-4.3 Possesses skills in using mathematical methods for processing information obtained as a result of experimental research, basic methods for analyzing the mechanics of motion and controlling the motion of spacecraft based on standard methods and software packages
PC-5	Able to develop, debug, test performance, modify software; apply software design methods and tools, develop and coordinate software documentation	PC-5.1 Knows existing system and application software, methods of designing and developing software, structures and databases, software interfaces. Knows regulatory and technical documentation for developing software documentation for software PC-5.2 Can apply methods and tools for designing software, data structures, databases, and software interfaces. Can analyze regulatory and technical documentation for developing software documentation. PC-5.3 Possesses basic skills in technologies for development, debugging, testing the functionality and

Cipher	Competence	Indicators of Competence Achievement (within the framework of this discipline)
		modification of system application software, and upgrading technical solutions for software development

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

Technological practice refers to the optional component of the compulsory part of block 2 of the curriculum.

As part of the educational program, students also master disciplines and/or other practices that contribute to the achievement of planned learning outcomes following the completion of technological practice.

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-1	Able to search, critically analyze and synthesize information, and apply a systematic approach to solving assigned tasks.	History of Russia / History of Russia Jurisprudence / Legal Science Philosophy / Philosophy Introduction to the Specialty / Introduction to the Specialty Business Ethics / Business Ethics Sociology / Sociology Cultural Studies Research Work / Research work Technological Training / Technological Practice	State final certification
UC-2	Able to define a range of tasks within the framework of a set goal and select optimal ways to solve them, based on current legal regulations, available resources and limitations	Jurisprudence / Legal Science Fundamentals of Project Activities Research Work / Research work Technological Training / Technological Practice	State final certification
UC-3	Able to interact socially and fulfill his/her role in a team	Psychology and Pedagogy / Psychology and Pedagogy Fundamentals of Project Activities Research Work / Research work Technological Training / Technological Practice	State final certification
UC-4	Capable of interpersonal and intercultural	Russian Language and Speech Culture / Russian	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
	communication interaction in Russian (as a foreign language) and foreign language(s) based on proficiency in interconnected and interdependent types of reproductive and productive foreign language speech activity, such as listening, speaking, reading, writing and translation in everyday, socio-cultural, educational and professional, official business and scientific areas of communication.	language and speech culture Russian as a Foreign Language / Russian language (as a foreign language) Foreign Language / Foreign Language Professional Russian (as a foreign language) in professional activities / Russian language (as a foreign language) in professional activities Foreign Language in Professional Activities / Foreign Language in Professional Activities Culture of scientific and business speech Research Work / Research work	
UC-5	Able to perceive the intercultural diversity of society in socio-historical, ethical and philosophical contexts.	History of Russia / History of Russia History of religions in Russia / History of religions in Russia Fundamentals of Russian Statehood / Fundamentals of Russian Statehood Philosophy / Philosophy Business Ethics / Business Ethics Sociology / Sociology Cultural Studies Political science / Political science Research Work / Research work	State final certification
UC-6	Able to manage their time, build and implement a trajectory of self-development based on the principles of lifelong education	History of Russia / History of Russia Fundamentals of Engineering Economics and Management / Fundamentals of Engineering Economics and Management Psychology and Pedagogy / Psychology and Pedagogy Physical Culture / Physical Culture	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
		Introduction to the Specialty / Introduction to the Specialty Fundamentals of Project Activities Research Work / Research work Technological Training / Technological Practice	
UC-7	Able to maintain an adequate level of physical fitness to ensure full social and professional activity	Basic military training. Life safety / Basics of military training. Life safety Physical Culture / Physical Culture Applied Physical Education / Applied Physical Education Research Work / Research work	State final certification
UC-8	Capable of creating and maintaining safe living conditions in everyday life and professional activities to preserve the natural environment, ensure sustainable development of society, including in the event of a threat or occurrence of emergency situations and military conflicts	Basic military training. Life safety / Basics of military training. Life safety Jurisprudence / Legal Science Research Work / Research work	State final certification
UC-9	Understands the basic principles of the functioning of the economy and economic development, the goals of the form of state participation in the economy Jurisprudence Introduction to the Internet of Things Introduction to the Internet of Things (in English)	Basic military training. Life safety / Basics of military training. Life safety Psychology and Pedagogy / Psychology and Pedagogy Jurisprudence / Legal Science Research Work / Research work	State final certification
UC-10	Able to make informed economic decisions in various areas of life	History of Russia / History of Russia Fundamentals of Engineering Economics and Management / Fundamentals of	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
		Engineering Economics and Management Jurisprudence / Legal Science Research Work / Research work	
UC-11	Capable of forming an intolerant attitude towards manifestations of extremism, terrorism, corrupt behavior and counteracting them in professional activities	Jurisprudence / Legal Science Fundamentals of Artificial Intelligence / Fundamentals of Artificial Intelligence Research Work / Research work	State final certification
UC-12	Capable of: searching for the necessary sources of information and data, perceiving, analyzing, memorizing and transmitting information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information obtained to solve problems; evaluating information, its reliability, building logical conclusions based on incoming information and data	Analysis of Geoinformation Data / Analysis of Geoinformation Data Automatic Control Theory Optimal Control Methods / Methods of optimal control Fundamentals of information security and cyber resilience / Fundamentals of information security and cyber resilience Fundamentals of Information Security and Cyber Resilience Research Work / Research work Technological Training / Technological Practice	State final certification
GPC-1	Able to analyze the tasks of professional activity based on provisions, laws and methods in the field of natural sciences and mathematics	Mathematical Analysis / Mathematical Analysis Algebra and Geometry / Algebra and Geometry Physics / Physics Complex Analysis Space Flight Mechanics / Space Flight Mechanics Research Work / Research work Technological Training / Technological Practice	State final certification
GPC-2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and natural	Mathematical Analysis / Mathematical Analysis Algebra and Geometry / Algebra and Geometry	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
	science disciplines (modules)	Equations of Mathematical Physics / Equations of Mathematical Physics Space Flight Mechanics / Space Flight Mechanics Analysis of Geoinformation Data / Analysis of Geoinformation Data Numerical Methods / Numerical Methods Automatic Control Theory Research Work / Research work Technological Training / Technological Practice	
GPC-3	Able to use fundamental knowledge to solve basic management problems in technical systems in order to improve in professional activities	Mathematical Analysis / Mathematical Analysis Algebra and Geometry / Algebra and Geometry Theory of Probability and Mathematical Statistics Differential Equations / Differential Equations Complex Analysis Equations of Mathematical Physics / Equations of Mathematical Physics Research Work / Research work Technological Training / Technological Practice	State final certification
GPC-4	Capable of assessing the effectiveness of management systems developed on the basis of mathematical methods	Differential Equations / Differential Equations Analysis of Geoinformation Data / Analysis of Geoinformation Data Research Work / Research work Technological Training / Technological Practice	State final certification
GPC-5	Capable of solving problems of development of science, engineering and technology in the field of control in technical systems, taking into account legal regulation in the field of intellectual property	Fundamentals of Artificial Intelligence / Fundamentals of Artificial Intelligence Theoretical Mechanics / Theoretical Mechanics Analysis of Geoinformation Data / Analysis of Geoinformation Data	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
		Automatic Control Theory Research Work / Research work Technological Training / Technological Practice	
GPC-6	Capable of developing and using algorithms and programs, modern information technologies, methods and means of control, diagnostics and management, suitable for practical application in the field of his professional activity	Computer Science and Programming / Computer Science and Programming Space Flight Mechanics / Space Flight Mechanics Automatic Control Theory Research Work / Research work	State final certification
GPC-7	Capable of making the necessary calculations of individual units and devices of control, automation and management systems, selecting standard automation, measuring and computing equipment when designing automation and management systems	Automatic Control Theory	State final certification
GPC-8	Capable of adjusting measuring and control equipment and systems, and performing their routine maintenance	Optimal Control Methods / Methods of optimal control	State final certification
GPC-9	Able to perform experiments using specified methods and process the results using modern information technologies and technical means.	Basic military training. Life safety / Basics of military training. Life safety Computer Science and Programming / Computer Science and Programming Analysis of Geoinformation Data / Analysis of Geoinformation Data Optimal Control Methods / Methods of optimal control Technological Training / Technological Practice	State final certification
GPC-10	Capable of developing (based on current standards) technical documentation (including in electronic form) for	Automatic Control Theory Technological Training / Technological Practice	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
	routine maintenance of control, automation and management systems and equipment		
GPC-11	Able to understand the principles of operation of modern information technologies and use them to solve problems of professional activity	Space Flight Mechanics / Space Flight Mechanics Optimal Control Methods / Methods of optimal control Technological Training / Technological Practice	State final certification
PC-1	Capable of collecting, processing and interpreting modern scientific research data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	Computer Science and Programming / Computer Science and Programming Computer Science and Programming / Computer Science and Programming Space Flight Mechanics / Space Flight Mechanics Analysis of Geoinformation Data / Analysis of Geoinformation Data Numerical Methods / Numerical Methods Automatic Control Theory Optimal Control Methods / Methods of optimal control Discrete Mathematics / Discrete Mathematics Discrete Mathematics Virtual and Augmented Reality Technology / Virtual and Augmented Reality Technologies Virtual and augmented reality technologies Research Work / Research work Technological Training / Technological Practice	State final certification
PC-2	Capable of participating in the development of schematic documentation for the flight control system of launch vehicles and spacecraft, in the preparation of publications based on the results of research and development	Space Flight Mechanics / Space Flight Mechanics	State final certification
PC-3	Capable of carrying out work on processing and analyzing information in	Analysis of Geoinformation Data /	State final certification

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
	the field of application of mathematical methods and information technologies in the field of application of remote sensing data of the Earth from space	Analysis of Geoinformation Data Research Work / Research work Technological Training / Technological Practice	
PC-4	Able to formulate, analyze and solve engineering problems in the field of ballistics, motion mechanics and spacecraft motion control based on professional knowledge	Theoretical Mechanics / Theoretical Mechanics Space Flight Mechanics / Space Flight Mechanics Optimal Control Methods / Methods of optimal control Research Work / Research work Technological Training / Technological Practice	State final certification
PC-5	Able to develop, debug, test performance, modify software; apply software design methods and tools, develop and coordinate software documentation	Analysis of Geoinformation Data / Analysis of Geoinformation Data Fundamentals of information security and cyber resilience / Fundamentals of information security and cyber resilience Fundamentals of Information Security and Cyber Resilience Virtual and Augmented Reality Technology / Virtual and Augmented Reality Technologies Virtual and augmented reality technologies Research Work / Research work Technological Training / Technological Practice	State final certification

* - filled in in accordance with the competency matrix and the SUP OP VO

4. SCOPE OF THE INTERSHIP

The total workload of Pre-graduation practice is 15 credit units (540 academic hours).

5. CONTENT OF THE INTERSHIP

*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	9
	Safety training at the workplace (in the laboratory and/or in production)	9
Section 2. Research	Introductory lectures	18
	Familiarization with the technological area/research laboratory of the enterprise	36
	Choice of research objects, drawing up a practice plan and a plan for a research final qualifying work	18
	Control and approval of plans for pre-graduation practice of research graduate qualification work	20
	Calculation and graphic part: analysis of individual initial data for calculation, selection and analysis of literature, execution of calculation work	340
	Ongoing monitoring of the internship by the supervisor	36
	Keeping a diary of your internship	36
Preparation of the internship report		9
Preparation for defense and defense of the internship report		9
TOTAL:		540

* - 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 CONDUCTING THE INTERSHIP

To conduct pre-graduation practice, laboratories equipped with modern computer equipment with Matlab, Borland Developer Studio, Python software and Internet access are required. Safety requirements are the same as when working with personal computers.

During pre-graduation practice at RUDN, the material and technical base of the graduation department, which trains bachelors in the field of "Control in Technical Systems", is used.

Scientific and educational laboratories of the department and enterprises where students can undergo practical training:

Audience with a list of logistical supplies	Location
Lecture and work premises of the enterprise	At the address of the enterprise: NPO "Eshelon" (Moscow) JSC "Astronomical Research Center" (Moscow);
"RUDN Flight Control Center": Set of specialized furniture; technical equipment: PC "Khopер" (4 pcs.), monitor 23.6 Viewsonic VG2433-LED (4 pcs.), projection screen Projecta Home Screen 316x416, LCD panel Philips 52 model BDL5231V/100, LCD panel for creating a video wall Orion OLM-4611 (1 pc.), LCD panel for creating a video wall Orion OLM-4611 (8 pcs.), acoustic system Bose Companion (1 pc.), interactive system 3D-Pointer, computer MEIJIN, personal computer (system unit Esprimo NYK3F0012776, monitor YEFQ614055), personal computer	Moscow, MiklUCHo-Maklaya st., 6.

(system unit Esprimo NYK3F0012794, monitor YEFQ614089), personal computer (system unit Esprimo YK1M001806, mon. YESV030505), personal computer (Esprimo system unit YKQBO48715, mon. YE7J36089), personal computer (Esprimo system unit YL6K005094, mon. YV1PQ13636), personal computer (Esprimo system unit YL6K005288, mon. YV2L010546). There is Internet access	
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7. METHOD OF CONDUCTING PRACTICE

Technological practice can be carried out both in RUDN structural divisions or in Moscow organizations (stationary), and at bases located outside of 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 terms of the internship correspond to the period specified in the academic calendar of the EP VO. The terms of the internship may be adjusted upon agreement with the Educational Policy Department and the Department of Organization of Internships and Employment of Students at RUDN.

8. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT FOR PRACTICE

Main literature:

1. Tolpegin, O. A. Methods of Optimal Control: Textbook and Workshop for Universities / O. A. Tolpegin. - 2nd ed., corrected. and additional. - Moscow: Publishing House Yurait, 2021. - 234 p. - (Higher education). - ISBN 978-5-534-13534-3. - Text: electronic // EBS Yurait [site]. - URL: <https://urait.ru/bcode/465342>.

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3. Aleksandrov V.V., Zlochevsky S.I., Lemak S.S., Parusnikov N.A. Introduction to the dynamics of controlled systems. M, Moscow State University, 1993.

5. Alekseev V.M., Galeev E.M., Tikhomirov V.M. Collection of optimization problems. M., NaUCa, 1984.

6. Atans M., Falb P. Optimal control. Moscow, Mechanical Engineering, 1968.

7. Bliss G.A. Lectures on the calculus of variations. Moscow, Foreign Literature, 1950.

8. Boltyansky V.G. Mathematical methods of optimal control. Moscow, NaUCa, 1969.

9. Gnoensky L.S., Kamensky G.A., Elsgolts L.E. Mathematical foundations of the theory of controlled systems. Moscow, NaUCa, 1969.

10. Pontryagin L.S., Boltyansky V.G., Gamkrelidze V.R., Mishchenko E.F. Mathematical theory of optimal processes. Moscow, Fizmatgiz, 1961.

11. Roytenberg Ya.N. Automatic control. Moscow, NaUCa, 1992.

12. Solodovnikov V.V., Plotnikov V.N., Yakovlev A.V. Theory of automatic control of technical systems. Moscow, Publishing House of Moscow State Technical University, 1993.

13. Methods of classical and modern theory of automatic control: Textbook in 5 volumes. Volume 1: Mathematical models, dynamic characteristics and analysis of automatic control systems / Under the general editorship of K.A. Pupkov. - 2nd ed., revised and enlarged. - Moscow: Publishing house of Moscow State Technical University, 2004. - 656 p.

14. Collection of problems for the course "Theory of Automatic Control": educational and methodological manual / K. A. Pupkov, D. A. Andrikov; Russian Peoples' Friendship University. - Moscow: RUDN University, 2014 (Moscow: RUDN University). - 107 p.
15. Nefedov V.N., Osipova V.A. Course of discrete mathematics: Textbook. – M.: MAI Publishing House, 1992.
16. Kuznetsov O.P., Adelson-Velsky G.M. Discrete Mathematics for an Engineer. – M.: Energoatomizdat, 1988.
17. Gurov V.V., ChUCanov V.O. Fundamentals of the Theory and Organization of Computers - Internet University of Information Technologies - INTUIT.ru”, 2006 - 280 p.
18. Cormen Thomas H., Leiserson Charles I., Rivest Ronald L., Stein Clifford Algorithms. Construction and Analysis, 2nd edition – Moscow: Williams Publishing House, 2007. - 1296 p.
19. Knuth Donald E. The Art of Computer Programming in 3 volumes – M.: Williams Publishing House, 2008. – T.1 – 720, T.2 – 832 p., T.3 - 824 p.
20. Aho Alfred V., Hopcroft John, Ullman Jeffrey D., Data structures and algorithms - – M.: Williams Publishing House, 2000. – 384 p.
21. MalyUC A.A., Pazizin S.V., Pogozhin N.S. Introduction to information security in automated systems – M.: Goryachaya Liniya-Telecom, 2001, 148 p.
22. Belov E.B., Los V.P., Meshcheryakov R.V., Shelupanov A.A. Fundamentals of information security. Textbook for universities, Moscow: Hotline – Telecom, 2006. - 544 p.
23. Tikhonov V.A., Reich V.V. Information security: conceptual, legal, organizational and technical aspects: textbook. manual. – M.: Helios ARV, 2006.- 528 p.
24. Shan'gin V.F. Information security of computer systems and networks: textbook. Manual. - M.: ID "FORUM": INFRA-M, 2008.-416 p.
25. Moore T., Pym D., Ioannidis C., Economics of Information Security and Privacy, Springer, 2010, - 320 pp.
26. Ensuring information security of business, Edited by Kurilo A.P., Alpina Publishers, 2011, - 392 p.
27. Bondarev V.V. Introduction to information security of automated systems (2nd edition). - M.: Bauman Moscow State Technical University. 2018. - 252 p.
28. Organizational and legal support of information security. edited by A.A. Alexandrov, M.P. Sychev – M.: Bauman Moscow State Technical University. 2018. – 292s.
29. MalyUC A.A. Fundamentals of security policy for critical information infrastructure systems. - M.: Hotline - Telecom, 2018. - 314 p.

Further reading:

1. Matthews J.G., Fink K.D. Numerical Methods. Using Matlab. – M., St. Petersburg, Kyiv: Williams Publishing House, 714 p.
2. Demidovich B.P., Maron I.A., Shuvalova E.Z. Fundamentals of computational mathematics. – St. Petersburg: Lan Publishing House, 2006.
3. Kopchenova N.V., Maron I.A. Computational Mathematics in Examples and Problems. – Moscow: NaUCa, 1972.
4. Samarskii A.A. Introduction to numerical methods. – M.: NaUCa, 1997.
5. Voevodin V.V., Kuznetsov Yu.A. Matrices and calculations. – M.: NaUCa, 1984.
6. Ortega J., Poole W. Introduction to Numerical Methods for Solving Differential Equations. – Moscow: NaUCa, 1986.
7. Zadeh L., Desoer C. Theory of linear systems. (State space method). – Moscow: NaUCa, 1970.
8. Moroz A.I. Course in systems theory. – M.: Higher. school, 1987.

9. Wonham M. Linear Multidimensional Control Systems: Geometric Approach. – Moscow: NaUCa, 1980.
10. Topcheev Yu.I. Atlas for designing automatic control systems. – M.: Mashinostroenie, 1989.
11. Torokin A.A. Fundamentals of engineering and technical protection of information. – M.: Os'-89, 1998.-336 p.
12. Devyanin P.N., Mikhalsky O.O., Pravikov D.I., Shcherbakov A.Yu., Theoretical foundations of computer security, – M: Radio and communication, 2000. -192 p.
13. Pyarin V.A., Kuzmin A.S., Smirnov S.N. Security of electronic business. – M.: Helios ARB, 2002. – 432 p.
14. Snytnikov A.A. Licensing and certification in the field of information security. – M.: Gelios ARV, 2003.- 192 p.

Periodicals:

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/>

Software:

1. Specialized software for conducting practical training and generating reporting documentation for students:

- MATLAB
- Geoinformation system QGIS 3.4 64 bit and a set of modules for it (freely distributed under the GNU General Public License version 2 (GNU GPL 2));
- Python programming language and development environment (freely distributed under the Python Software Foundation License);

- Borland Developer Studio 2006 (License Certificate Number: 33080, 33081, 33082)

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 pre-graduation practice (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. EVALUATION MATERIALS 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 passing Pre-graduation practice is presented in the Appendix to this Practice Program (module).

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

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