

General characteristics of the Educational Program of Higher Education

1.1. Purpose (mission) of the Educational Program (EP) of Higher Education (HE)

The program is focused on the training of highly qualified specialists in the training direction of 01.06.01 Mathematics and Mechanics in the program «Dynamics, Strength of Machines, Devices and Equipment (Technical Science)». The curriculum is designed in such a way that it allows students to form the professional competencies that are currently in demand. The purpose of the program is to create conditions for the acquisition of the necessary level of knowledge, skills, skills, experience of activity and preparation for the defense of a Scientific Qualification Work (dissertation) for the degree of candidate of sciences, as well as conducting scientific research in the interests of the development of science, humanity, and humanitarian values. Research activities within the framework of the educational program cover the field of science and technology, which studies the behavior of technical objects for various purposes, the patterns of mechanical phenomena and related processes of a different nature (pneumohydraulic, thermal, electrical, etc.), which take place in machines, devices, structures, and their elements, as well as in natural and artificial materials by methods of mechanics and computational mathematics.

The educational program has an intersectoral character, since the problems of strength, stability, durability, rational optimization, resource, survivability, reliability and safety of structures of machines and structures are important in most high-tech industries: traditional and nuclear energy, aircraft construction, rocket engineering, mechanical engineering, instrument making, traditional and pipeline transport, industrial, civil and special construction.

In the course of training, postgraduates receive theoretical and practical training and skills of research and scientific and pedagogical work, which allow them to work effectively after completing the study of the educational program at enterprises of various fields and industries in managerial positions, as well as in research and educational organizations.

The objectives of the postgraduate training program in the direction of 01.06.01 Mathematics and Mechanics is a specific implementation of the more global mission of RUDN University.

1.2. Basic information

The main professional educational program in the direction of 01.06.01 Mathematics and Mechanics in the program «Dynamics, strength of machines, devices and equipment (Technical Science)» is implemented in full-time education in accordance with the license for the right to carry out educational activities.

The normative term for mastering the main educational program in the postgraduate student's training direction 01.06.01 Mathematics and mechanics in full-time education is 4 years.

The volume of the postgraduate program is 240 credit units (hereinafter – c.u.). The volume of the postgraduate study program, implemented in one academic year, is 60 c.u.

1.3 Implementation features of the EP of HE

The program is implemented without the use of a network form, without the use of distance educational technologies, with the use of e-learning elements using the TUIS RUDN system.

Educational activities for the postgraduate program are carried out in English.

As a result of mastering the program, graduate students receive in-depth scientific, engineering, and technical knowledge, which will not only form the necessary professional skills, but also help develop a penchant for creative thinking. The knowledge gained in the course of training is consolidated and implemented in professional activities during the internship and the performance of the graduate qualification work of the graduate student.

1.4. Labor market needs for graduates of the EP of HE

Graduates who have mastered this program are focused on working in Russian and international companies, enterprises, educational institutions, research organizations in various fields of industry related to the dynamics, strength of machines, devices, and equipment.

The area of professional activity of graduates who have mastered the postgraduate program includes the area of professional activity of graduates, which includes the spheres of science, technology, technology and pedagogy, covering the totality of tasks in the direction of Mathematics and Mechanics.

In the professional field, the main consumers of the educational program are such Russian and international enterprises as:

- Federal State Unitary Enterprise «Central Research Institute of Mechanical Engineering» (FSUE TsNIIMash Korolyov);
- «Russian Space Systems» JSC;
- Rocket and Space Corporation named after S.P. Korolyov (RSC Energy Korolyov);
- FSUE «Scientific Research Institute of Aviation Systems» (GosNIAS);
- Federal State Autonomous Educational Institution of Higher Education «Peoples' Friendship University of Russia»;
- Federal State Educational Institution of Higher Education «Bauman Moscow State Technical University (National Research University)» (MSTU named after N.E. Bauman);
- Moscow Aviation Institute (National Research University) (MAI) and other Federal State Institution;
- «Federal Research Center Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences»
- Federal State Budgetary Institution of Science «V. A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences» (ICS RAS);
- Computing Center named after A. A. Dorodnicyn of the Russian Academy of Sciences of the Federal Research Center "Informatics and Management" of the Russian Academy of Sciences (CC RAS);
- «Yandex» LLC;
- Kaspersky Lab;
- MathWorks Inc;
- Microsoft Corporation.

1.5. Requirements for the entrant

Admission to the program is subject to the Admission Rules approved by the relevant local regulatory act and published in the public domain on the official website of the RUDN University.

1.6. Characteristics of the professional activity of the graduate of the EP:

1.6.1 Field of professional activity:

The area of professional activity of graduates who have mastered the postgraduate program includes the spheres of science, technology, technology and pedagogy, covering the totality of tasks of the Mathematics and Mechanics direction, including high-tech production of the aerospace complex, aircraft construction, mechanical engineering, research and analytical centers of various profiles, as well as funds, insurance and management companies, financial organizations and business structures in the socio-economic sphere, and educational institutions of higher education.

The areas of activity of the postgraduate program «Dynamics, strength of machines, devices and equipment (Technical Science)» include the fields of science and technology that study the behavior of technical objects for various purposes, the patterns of mechanical phenomena and related processes of a different nature (pneumohydraulic, thermal, electrical, etc.), which take place in machines, devices,

structures and their elements, as well as in natural and artificial materials by methods of mechanics and computational mathematics.

1.6.2 Objects of professional activity:

The objects of professional activity of graduates who have mastered the postgraduate program are the chosen field of scientific knowledge, as well as concepts, hypotheses, theorems, physical and mathematical models, numerical algorithms and programs, methods of experimental research of the properties of materials and natural phenomena, physical and chemical processes that make up the content of fundamental and applied mathematics, mechanics, and other natural sciences.

The chosen field of scientific knowledge is the dynamics, strength of machines, devices, and equipment.

The postgraduate program is aimed at mastering all types of professional activities for which the graduate is preparing.

When developing and implementing postgraduate programs, the scientific supervisor of the educational program focuses on a specific type (types) of professional activity for which a graduate student is preparing, based on the needs of the labor market, research and material resources of the structural units involved in the implementation of the educational program.

1.6.3 Tasks of professional activity:

Within the framework of this field of study, a postgraduate student is prepared for research activities in universities, research, and production enterprises of any form of ownership, as well as for teaching activities in higher education institutions.

The types of professional activities for which graduates who have mastered the postgraduate program are prepared:

- research activities in the fields of science and technology that study the behavior of technical objects for various purposes, the patterns of mechanical phenomena and related processes of a different nature (pneumohydraulic, thermal, electrical, etc.), which take place in machines, devices, structures and their elements, as well as in natural and artificial materials by methods of mechanics and computational mathematics;

- teaching activities in educational programs of higher education.

1.6.4. Tasks of professional activity of the graduate

A graduate who has mastered the postgraduate program, in accordance with the types of professional activities that the educational program is focused on, is ready to solve the following professional tasks:

The tasks of the professional activity of a graduate student are:

- independent (including leading) research activities, requiring broad fundamental training in modern areas of technical systems management, design of intelligent and information-control systems, deep specialized training in the chosen direction, possession of skills in modern research methods.

- scientific and pedagogical work in higher and secondary specialized educational institutions.

1.7. Requirements for the results of mastering the main educational program

The results of mastering the EP of postgraduate study are determined by the competencies acquired by the graduate, i.e., his/her ability to apply knowledge, skills, and personal qualities in accordance with the tasks of professional activity.

As a result of mastering this EP of higher professional education (training of highly qualified personnel), the graduate must have the following competencies:

Universal Competencies (UC):

- the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary areas (UC-1);

- the ability to design and implement complex research, including interdisciplinary research, based on a holistic, systematic scientific worldview, using knowledge in the field of history and philosophy of science (UC-2);
- the willingness to participate in the work of Russian and international research teams to solve scientific and scientific-educational tasks (UC-3);
- the willingness to use modern methods and technologies of scientific communication in the state and foreign languages, including the readiness for communication in oral and written forms in Russian and foreign languages to solve the problems of professional activity, possession of foreign language communicative competence in official business, educational and professional, scientific, socio-cultural, everyday life spheres of foreign language communication (UC-4);
- the ability to plan and solve problems of their own professional and personal development (UC-5).

The graduate of the postgraduate program must have the following **General Professional Competencies (GPC)**:

- the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies (GPC-1);
- the willingness to teach in the main educational programs of higher education (GPC-2).

The graduate of the postgraduate program must have the following **Professional Competencies (PC)**:

- the willingness to apply promising methods of research and solving professional problems, considering global trends in the development of technical facilities for various purposes (PC-1);
- the ability to identify the essence of scientific and technical problems that arise during professional activity, and to apply to their solution the physical and mathematical apparatus, theoretical, computational, and experimental research methods, methods of mathematical and computer modeling (PC-2);
- the willingness to carry out research work and solve scientific and technical problems in the field of applied mechanics based on the achievements of engineering and technology, classical and technical theories, and methods, physical and mechanical, mathematical and computer models that have a high degree of adequacy to real processes, machines, and structures (PC-3);
- the ability to create new generations of machines, devices, equipment, technologies, and materials that have qualitatively new functional properties, as well as to improve existing machines, devices, equipment, and technologies that have increased operational characteristics, lower material, and energy consumption (PC-4);
- the ability to develop methods of mechanics and computational mathematics, computer technologies and decision support systems in scientific research, design, and engineering activities (PC-5);
- the ability to study patterns and connections, dynamic processes, stress states and strength of machines, devices, and equipment (PC-6);
- the willingness to teach courses, disciplines (modules), conduct certain types of training sessions in Russian and foreign languages in higher education programs (PC-7);
- the ability to organize educational, research and project activities of students in higher education programs (PC-8).

1.8. Competence Matrix

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	Name of disciplines (modules) in accordance with the curriculum	UC-1: the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary areas	UC-2: the ability to design and implement complex research, including interdisciplinary research, based on a holistic, systematic scientific worldview, using knowledge in the field of history and philosophy of science	UC-3: the willingness to participate in the work of Russian and international research teams to solve scientific and scientific-educational tasks	UC-4: the willingness to use modern methods and technologies of scientific communication in the state and foreign languages, including the readiness for communication in oral and written forms in Russian and foreign languages to solve the problems of professional activity, possession of foreign language communicative competence in official business, educational and professional, scientific, socio-cultural, everyday life spheres of foreign language communication	UC-5: the ability to plan and solve problems of their own professional and personal development
Block 1	Basic part					
Б1.Б.01	Foreign Language / Иностранный язык			+	+	
Б1.Б.02	History and Philosophy of Science / История и философия науки	+	+			+
Block 1	Variable part					
Б1.В.01	Methodology of Scientific Research / Методология научных исследований	+	+	+		

Б1.В.02	Priority Directions of Development of Mathematics and Mechanics / Приоритетные направления развития математики и механики		+	+		+
Б1.В.03	Fundamentals of Teaching Methods of Development of Engineering Applications Based on Mathematical Modeling Using Computer Science and Computer Technology in high school / Основы преподавания методов разработки инженерных приложений на основе математического моделирования с использованием информатики и вычислительной техники в высшей школе					+
Б1.В.04	Dynamics, strength of machines, devices and equipment / Динамика, прочность машин, приборов и аппаратуры	+				+
Б1.В.ДВ.01.01	Technology and engineering of nanodevices and systems / Технология и инженерия наноустройств и систем	+				
Б1.В.ДВ.01.02	System analysis, management and information processing / Системный анализ, управление и обработка информации	+				
Б1.В.ДВ.01.03	Modern problems of management theory / Современные проблемы теории управления	+				

Б1.В.ДВ.01.04	A discipline of choice from another program (within the branch of science)					
Б1.В.ДВ.02.01	Foreign Language in the Sphere of Professional Communication /			+	+	
Б1.В.ДВ.02.02	Russian Language in the Sphere of Professional Communication / Русский язык в сфере профессиональной коммуникации			+	+	
Block 2	Practices					
Б2.В.01(П)	Practice in Obtaining Professional Skills and Professional Experience (Research Practice) / Практика по получению профессиональных умений и опыта профессиональной деятельности (научно-исследовательская практика)				+	
Б2.В.02(П)	Pedagogical practice / Педагогическая практика					
Block 3	Scientific research					
Б3.В.01(Н)	Scientific Research / Научные исследования (научно-исследовательская деятельность)			+		+
Б3.В.02(Н)	Scientific Research / Научные исследования (подготовка научно-квалификационной работы (диссертации) на соискание ученой степени кандидата наук)			+		+

Block 4	State Final Certification					
Б4.Б.01(Г)	State Exam / Подготовка к сдаче и сдача государственного экзамена	+	+	+	+	+
Б4.Б.02(Д)	PhD Qualification Thesis and Presentation / Представление научного доклада об основных результатах подготовленной научно-квалификационной работы (диссертации)	+	+	+	+	+

	Name of disciplines (modules) in accordance with the curriculum	GPC-1: the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies	GPC-2: the willingness to teach in the main educational programs of higher education
Block 1	Basic part		
Б1.Б.01	Foreign Language / Иностранный язык		
Б1.Б.02	History and Philosophy of Science / История и философия науки		
Б1.В.01	Methodology of Scientific Research / Методология научных исследований	+	
Б1.В.02	Priority Directions of Development of Mathematics and Mechanics / Приоритетные направления развития математики и механики	+	

Б1.В.03	Fundamentals of Teaching Methods of Development of Engineering Applications Based on Mathematical Modeling Using Computer Science and Computer Technology in high school / Основы преподавания методов разработки инженерных приложений на основе математического моделирования с использованием информатики и вычислительной техники в высшей школе		+
Б1.В.04	Dynamics, strength of machines, devices and equipment / Динамика, прочность машин, приборов и аппаратуры		+
Б1.В.ДВ.01.01	Technology and engineering of nanodevices and systems / Технология и инженерия наноустройств и систем		
Б1.В.ДВ.01.02	System analysis, management and information processing / Системный анализ, управление и обработка информации		
Б1.В.ДВ.01.03	Modern problems of management theory / Современные проблемы теории управления		
Б1.В.ДВ.01.04	A discipline of choice from another program (within the branch of science)		

Б1.В.ДВ.02.01	Foreign Language in the Sphere of Professional Communication / Иностранный язык в сфере профессиональной коммуникации		
Б1.В.ДВ.02.02	Russian Language in the Sphere of Professional Communication / Русский язык в сфере профессиональной коммуникации		
Block 2	Practices		
Б2.В.01(П)	Practice in Obtaining Professional Skills and Professional Experience (Research Practice) / Практика по получению профессиональных умений и опыта профессиональной деятельности (научно-исследовательская практика)	+	
Б2.В.02(П)	Pedagogical practice / Педагогическая практика		+
Block 3	Scientific research		
Б3.В.01(Н)	Scientific Research / Научные исследования (научно-исследовательская деятельность)	+	
Б3.В.02(Н)	Scientific Research / Научные исследования (подготовка научно-квалификационной работы (диссертации) на соискание ученой степени кандидата наук)	+	
Block 4	State Final Certification		

Б4.Б.01(Г)	State Exam / Подготовка к сдаче и сдача государственного экзамена	+	+
Б4.Б.02(Д)	PhD Qualification Thesis and Presentation / Представление научного доклада об основных результатах подготовленной научно-квалификационной работы (диссертации)	+	+

		Professional competence							
Name of disciplines (modules) in accordance with the curriculum		PC-1: the willingness to apply promising methods of research and solving professional problems, considering global trends in the development of technical facilities for various purposes	PC-2: the ability to identify the essence of scientific and technical problems that arise during professional activity, and to apply to their solution the physical and mathematical apparatus, theoretical, computational, and experimental research methods, methods of mathematical and computer modeling	PC-3: the willingness to carry out research work and solve scientific and technical problems in the field of applied mechanics based on the achievements of engineering and technology, classical and technical theories, and methods, physical and mechanical, mathematical and computer models that have a high degree of adequacy to real processes, machines, and structures	PC-4: the ability to create new generations of machines, devices, equipment, technologies, and materials that have qualitatively new functional properties, as well as to improve existing machines, devices, equipment, and technologies that have increased operational characteristics, lower material, and energy consumption	PC-5: the ability to develop methods of mechanics and computational mathematics, computer technologies and decision support systems in scientific research, design, and engineering activities	PC-6: the ability to study patterns and connections, dynamic processes, stress states and strength of machines, devices, and equipment	PC-7: the willingness to teach courses, disciplines (modules), conduct certain types of training sessions in Russian and foreign languages in higher education programs	PC-8: the ability to organize educational, research and project activities of students in higher education programs
Block 1	Basic part								
Б1.Б.01	Foreign Language / Иностранный язык								
Б1.Б.02	History and Philosophy of Science / История и								
Б1.Б.01	Methodology of Scientific Research / Методология научных исследований	+	+	+					
Б1.Б.02	Priority Directions of Development of Mathematics	+		+			+		

Б1.В.ДВ.01.04	A discipline of choice from another program (within the branch of science)								
Б1.В.ДВ.02.01	Foreign Language in the Sphere of Professional Communication / Иностранный язык в сфере профессиональной коммуникации								
Б1.В.ДВ.02.02	Russian Language in the Sphere of Professional Communication / Русский язык в сфере профессиональной								
Block 2	Practices								
Б2.В.01(П)	Practice in Obtaining Professional Skills and Professional Experience (Research Practice) / Практика по получению профессиональных умений и опыта профессиональной деятельности (научно-исследовательская практика)	+	+		+	+	+		
Б2.В.02(П)	Pedagogical practice / Педагогическая практика							+	+
Block 3	Scientific research								
Б3.В.01(Н)	Scientific Research / Научные исследования (научно-исследовательская деятельность)								

Б3.В.02(Н)	Scientific Research / Научные исследования (подготовка научно-квалификационной работы (диссертации) на соискание ученой степени кандидата наук)								
Block 4	State Final Certification								
Б4.Б.01(Г)	State Exam / Подготовка к сдаче и сдача государственного экзамена	+	+	+	+	+	+	+	+
Б4.Б.02(Д)	PhD Qualification Thesis and Presentation / Представление научного доклада об основных результатах подготовленной научно-квалификационной работы (диссертации)	+	+	+	+	+	+	+	+