

*«RUDN University»*

*Engineering Academy*

## **SCIENTIFIC RESEARCH PROGRAM**

**Practice type:** Internship

**Type (name) of practice:** Practice in Obtaining Professional Skills and Professional Experience (Research Practice)

**Direction:** 01.06.01 Mathematics and Mechanics

**Scientific specialty:** Dynamics, strength of machines, devices and equipment (Technical Science)

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## 1. The purpose and objectives of the practice

The practice of obtaining professional skills and experience of professional activity (research) is a production practice and is aimed at acquiring practical skills of independent research work, consolidating theoretical knowledge gained during classroom, practical, laboratory and educational research studies, as well as introducing a graduate student to the social environment in order to acquire social and personal competencies necessary for work in the professional sphere.

**The main objectives** of the Practice for obtaining professional skills and professional experience (research) are:

- to study the experience of scientific and analytical activities;
- to learn the skills of presenting the results obtained in the form of reports, publications, reports;
- to master modern methods and methodology of scientific research.

## 2. The place of research practice in the structure of the educational program of higher education

The practice of obtaining professional skills and professional experience (research) belongs to the variable part of Block 2 of the curriculum. Its passage is based on the material of previous disciplines and / or practices, and it is also basic for the study of subsequent disciplines and / or practices of the curriculum, the list of which is presented in Table 1.

*Table 1 - List of previous and subsequent disciplines / practices*

<b>№</b>	<b>Prior disciplines / practices</b>	<b>Subsequent disciplines</b>
1	Fundamentals of teaching methods of developing engineering applications based on mathematical modeling using informatics and computer technology in higher education.	System analysis, management and information processing
2	Research methodology	Dynamics, strength of machines, devices and equipment
		State final certification

## 3. Practice methods

The methods of conducting the Practice for obtaining professional skills and professional experience (research) are as follows:

- stationary.

## 4. The scope of practice and types of educational work

*Table 2 - Scope of practice and types of educational work*

Type of educational work	Total, ac. hours	Semester	
		1	2

Contact work of the student with the teacher, including control		44	22	22
Other forms of educational work, including keeping a diary of practice and preparing a report for students		172	86	86
Type of certification test			Graded credit	Graded credit
Total labor intensity	academic hours	216	108	108
	credit units	6	3	3
Duration of practice	weeks	Distributed	Distributed	Distributed

## 5. Place of practice

The place of internship is provided to the student by the head of the internship on the basis of the relevant agreements concluded with the basic organizations.

The bases for the students to undergo the Practice for obtaining professional skills and professional experience (research) is the Department of Mechanics and Mechatronics of the Institute of Space Technologies of the RUDN University.

A postgraduate student can come up with an initiative about the place of internship. The direction of the professional activity of the organization offered to students for internship must correspond to the profile of the educational program and the types of professional activity for which the graduate of the program is preparing. The place of the internship must be agreed with the head of the department / department with the subsequent (with a positive decision) the conclusion of an appropriate agreement with the organization proposed by the student.

Postgraduate students with disabilities and / or those belonging to the category of "disabled" undergo practical training in a form accessible to them in the laboratories of the university, as well as in specialized organizations with which the relevant agreements have been concluded and which have the opportunity (equipment, special means and infrastructure) to work with these categories of citizens.

## 6. The list of the planned results of the internship, correlated with the planned results of the development of the educational program

The practice of obtaining professional skills and experience of professional activity (research) is aimed at developing the following competencies in students (GPC-1; UC-4; PC-1; PC-2; PC-4; PC-5; PC-6):

- 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 readiness 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-everyday spheres of foreign language communication (UC-4);

- willingness to apply promising research methods and solve professional problems, taking into account global trends in the development of technical objects for various purposes (PC-1);
- the ability to identify the essence of scientific and technical problems arising in the course of professional activity, and to apply the physical and mathematical apparatus, theoretical, computational and experimental research methods, methods of mathematical and computer modeling to solve them (PC-2);
- the ability to create new generations of machines, devices, equipment, technologies and materials with qualitatively new functional properties, as well as to improve existing machines, devices, equipment and technologies with increased operational characteristics, less material and energy consumption (PC-4);
- the ability to develop methods of mechanics and computational mathematics, computer technology and decision support systems in scientific research, design and engineering activities (PC-5).
- the ability to study patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment (PC-6).

The result of the practice is knowledge, skills, skills and experience of professional activity, which characterize the stages of the formation of competencies and ensure the achievement of the planned results of mastering the educational program, presented in Table 3.

*Table 3 - Learning outcomes in the discipline, correlated with the planned results of mastering of the educational program of higher education*

<b>Competence</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Skills</b>
1	2	3	4
willingness to apply promising research methods and solving professional problems, taking into account global trends in the development of technical objects for various purposes (PC-1)	Promising methods for the study of professional tasks. World trends in the development of technical objects for various purposes	Apply promising methods for researching professional tasks.	Solving professional tasks
the ability to identify the essence of scientific and technical problems arising in the course of professional activity, and to apply for their solution the physical and mathematical apparatus, theoretical, calculated and experimental research methods, methods of mathematical and computer modeling (PC-2)	Methods for solving scientific and technical problems arising in the course of professional activity	Revealing the essence of scientific and technical problems arising in the course of professional activity and solving these problems	Use the physical and mathematical apparatus, theoretical, computational and experimental research methods, methods of mathematical and computer modeling
the ability to create new generations of machines, devices, equipment,	Methodology for creating new generations of	create new generations of machines, devices,	creation of new generations of machines, devices,

technologies and materials with qualitatively new functional properties, as well as to improve existing machines, devices, equipment and technologies with increased operational characteristics, less material and energy consumption (PC-4)	machines, instruments, apparatus, technologies and materials with qualitatively new functional properties, as well as improving existing machines, instruments, apparatus and technologies with increased operational characteristics, less material and energy consumption	equipment, technologies and materials with qualitatively new functional properties, as well as improve existing machines, devices, equipment and technologies with improved performance, less material and energy consumption	equipment, technologies and materials with qualitatively new functional properties, as well as the improvement of existing machines, devices, equipment and technologies with increased operational characteristics, less material and energy consumption
the ability to develop methods of mechanics and computational mathematics, computer technology and decision support systems in scientific research, design and engineering activities (PC-5)	methods of mechanics and computational mathematics, computer technologies and decision support systems in scientific research, design and engineering activities	to develop methods of mechanics and computational mathematics, computer technologies and decision support systems in scientific research, design and engineering activities	development of methods of mechanics and computational mathematics, computer technologies and decision support systems in scientific research, design and engineering activities
the ability to study patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment (PC-6)	patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment	study patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment	studying patterns and relationships, dynamic processes, stress states and strength of machines, devices and equipment

## 7. Practice structure and content

<i>1 SEMESTER</i>					
№	Practice stages	Types of work carried out by students	Educational work on forms, academic hours		Total, academic hours
			Contact work	Other forms of educational work	
1	Organizational and preparatory	Receiving an individual assignment for practice from a supervisor	1	-	1
2		Workplace safety briefing (laboratory and / or production)	1	-	1
3	Main	Selection of the object and subject of scientific research	-	20	20

4		Statement of the goal and objectives of the dissertation research	-	20	10
5		Search for information, compilation of thematic lists of literature, catalogs, card files and other types of descriptions, classifications and typologies on the topic of the dissertation	-	20	10
		Ongoing control of the internship by the head	10	-	10
9	Reporting	Presentation and protection of the results of the work performed in the research practice		26	
10		Intermediate attestation (preparation for defense and defense of presentation)	10	-	10
<b>TOTAL:</b>			<b>22</b>	<b>86</b>	<b>108</b>
<b>2 SEMESTER</b>					
№	Practice stages	Types of work carried out by students	Educational work on forms, academic hours		Total, academic hours
			Contact work	Other forms of educational work	
1	Organizational and preparatory	Receiving an individual assignment for practice from a supervisor	1	-	1
2		Workplace safety briefing (laboratory and / or production)	1	-	1
3	Main	Justification of the relevance of the research topic	-	20	20
4		Determination of the degree of scientific elaboration of the research topic	-	20	20
5		Mastering the modern methodology of scientific research	-	20	20
8.		Keeping an internship diary	-	10	10
		Ongoing control of the internship by the supervisor	10	-	10
9	Reporting	Preparing an internship report	-	16	16
10		Intermediate attestation (preparation for protection and protection of the report)	10	-	10
<b>TOTAL:</b>			<b>22</b>	<b>86</b>	<b>108</b>

For students from among persons with disabilities and / or belonging to the category of "disabled", if necessary, the head of the practice develops individual tasks, a plan and procedure for passing the practice, taking into account the peculiarities of their psychophysical development, individual capabilities and health status, an educational program adapted for these students (if any) and in accordance with individual rehabilitation programs for the disabled.

### **8. Educational, research and production technologies used in practice**

In the process of passing the Practice for obtaining professional skills and professional experience (research), the following educational technologies are used:

- contact work of a student with a teacher, which consists in receiving an individual assignment, undergoing safety briefing, receiving advice on internship issues, filling out current and reporting documentation, as well as protecting a report on internship;
- other forms of educational work (educational activities), which include the main activity of the student on the implementation of sections of practice in accordance with the

individual task, recommended methods and literature sources, aimed at the formation of certain professional skills or experience of professional activity provided for by the practice program, as well as filling out the current and reporting documentation, and preparing for the defense of the report on the passage of internship.

During the internship, the following research and development technologies are used:

- mastering by students the methods of information analysis and interpretation of the results of research activities;
- execution of written analytical and calculation tasks within the framework of practice using recommended information sources;
- the use of various computer software products for graphic, analytical and / or industrial purposes (depending on the place of internship and the specifics of the task);
- use by students of various electronic library and legal reference systems, etc.

## **9. Educational-methodical and informational support of educational practice**

### *Main literature:*

1. Issledovanie sistem upravlenija: Uchebnoe posobie / Baranov V.V., Zajcev A.V., Sokolov S.N. - M.: Al'pina Pablsher, 2013. - 216 p. .  
<http://www.studentlibrary.ru/book/ISBN9785890358271>
2. Lapaeva, M.G. Metodologija nauchnyh issledovanij: uchebnoe posobie dlja aspirantov / M.G. Lapaeva, S.P. Lapaev; Ministerstvo obrazovanija i nauki Rossijskoj Federacii, Federal'noe gosudarstvennoe bjudzhetnoe obrazovatel'noe uchrezhdenie vysshego obrazovanija «Orenburgskij gosudarstvennyj universitet». – Orenburg : OGU, 2017. – 249 p. ISBN 978-5-7410-1791-3; [Электронный ресурс]. – URL: <http://biblioclub.ru/index.php?page=book&id=485476> (06.05.2018).
3. Osnovy nauchnyh issledovanij. [Jelektronnyj resurs] / Shkljar M.F. - M. : Dashkov i K, 2016. - <http://www.studentlibrary.ru/book/ISBN9785394018008.html>
4. Miroshnichenko N. A., Stefanov S. A. V pomoshh' molodomu prepodavatelju. metod. posobie/ N. A. Miroshnichenko, S. A. Stefanov.- Odessa: Juridichna literatura, 2003.-92 p.
5. Razvitie professionalizma prepodavatelja vysshej shkoly. ucheb.-metod. posobie. Izd. 2-e, ster./ V. S. Agapov - M.: Izd-vo RAGS, 2017.-384 p.  
[http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn\\_FindDoc&id=470098&idb=0](http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn_FindDoc&id=470098&idb=0)
6. Skok G.B., Lygina N.I. Kak sproektirovat' uchebnyj process po kursu: Uchebnoe posobie. Izd. vtoree, pererab. i dopoln. – M.: Pedagogicheskoe obshhestvo Rossii. 2017. – 96p.  
[http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn\\_FindDoc&id=470098&idb=0](http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn_FindDoc&id=470098&idb=0)
7. Upravlenie kachestvom obrazovanija: Praktiko-orientirovannaja monografija i metodicheskoe posobie/ Pod red. M.M. Potashnika. M., 2016.

### *Additional literature:*

1. Magisterskaja dissertacija [Jelektronnyj resurs]: uchebnoe posobie / K.S. Idiatullina, I.Z. Garafiev. - Kazan': Izdatel'stvo KNITU, 2015.  
[http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn\\_FindDoc&id=418786&idb=0](http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn_FindDoc&id=418786&idb=0)
2. Planirovanie i organizacija nauchnyh issledovanij [Jelektronnyj resurs] : uchebnoe posobie / V.I. Komlackij, S.V.Loginov, G.V. Komlackij. - Rostov n/D : Feniks, 2017. - [http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn\\_FindDoc&id=470098&idb=0](http://lib.rudn.ru/MegaPro2/UserEntry?Action=Rudn_FindDoc&id=470098&idb=0)

### *Periodicals:*

1. Journal "Expert"
2. Journal "Automation and control in technical systems"
3. Journal "Control systems, communications and security"

### *Resources of the information and telecommunications network "Internet":*

1. RUDN ELS and third-party ELS, to which university students have access on the basis of concluded agreements:

- RUDN electronic library system – RUDN ELS <http://lib.rudn.ru/MegaPro/Web>
- ELS «University library online» <http://www.biblioclub.ru>
- ELS Yurayt <http://www.biblio-online.ru>
- ELS «Student advisor» [www.studentlibrary.ru](http://www.studentlibrary.ru)
- ELS «Lan» <http://e.lanbook.com/>

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 database <http://www.elsevierscience.ru/products/scopus/>
- e-library <http://elibrary.ru/defaultx.asp>.

### *Software:*

The use of specialized software during the practice is not provided.

*Methodological materials for passing practice, maintaining current and preparing reporting documentation for students (also posted in the TUIS RUDN University in the relevant section of the discipline):*

1. Methodical instructions for passing practice, maintaining current and preparing reporting documentation for students in the direction 01.06.01 Mathematics and mechanics, profile "Dynamics, strength of machines, devices and equipment" (Appendix 2).

## **10. Material and technical support of educational practice**

For the successful conduct of educational practice on obtaining primary professional skills and abilities, you need: a workplace, a computer, a printer, a library fund.

To process the materials collected by the student during the practice to obtain professional skills and professional experience, there is access to computer classes.

The library fund must provide students with basic literature in the amount of 0.5 copies per person.

Also, students are given the opportunity to use the Internet in an educational institution.

## **11. Practice certification forms**



In the process of passing the practice, the teacher carries out current control of the student's implementation of the assignment for practice. Based on the results of the practice, intermediate certification is provided in the form of a set-off with an assessment (based on the results of the defense of the report on practice).

## **12. Fund of assessment tools for intermediate certification of students in practice**

The fund of assessment tools, formed for the current monitoring of progress and intermediate certification of students in the Practice in Obtaining Professional Skills and Professional Experience (Research Practice) is presented in Appendix 1 to the work program of the practice and includes:

- a list of competencies formed in the course of internship;
- description of indicators and criteria for assessing competencies, description of assessment scales;
- typical control tasks or other materials necessary to assess knowledge, skills, skills and (or) experience of activities, characterizing the level of competence formation;
- methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities, characterizing the level of competence formation.

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