

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION  
Federal State Autonomous Educational Institution  
higher education  
NORTH CAUCASIAN FEDERAL UNIVERSITY

**I APPROVE**

Dean of the Faculty of Mathematics and  
computer science named after Professor N.I.  
Chervyakov , Candidate of Physical and  
Mathematical Sciences, Associate Professor  
T.A. Grobova

**Internship Program**

Scientific Research Work (obtaining basic research skills) / Научно-исследовательская работа  
(получение первичных навыков научно-исследовательской работы)

|                                 |                                             |
|---------------------------------|---------------------------------------------|
| Direction of training           | 02.04.01 Mathematics and Computer Science   |
| Directionality (profile)        | Training Program for Electronic Information |
| Year of commencement of studies | 2026                                        |
| Form of study                   | full-time                                   |
| Implemented in a semester       | 3                                           |

**Developed by**

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of Computational Mathematics and  
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### **1. Objectives of the practice**

The objectives of the educational practice are: Scientific Research Work (obtaining basic research skills) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) in the field of study 02.04.01 – Mathematics and computer science profile «Training Program for Electronic Information» are:

- are the consolidation and deepening of theoretical knowledge;
- development of professional competencies related to the use of modern methods of processing and interpreting information in scientific research activities, with the organization of scientific and applied research, and the presentation of the results of scientific activities;
- developing students' professional skills in the application of modern mathematical methods and software to solve problems in science, technology, economics and management, and the use of information technology in design, engineering, management and financial activities in organizations, institutions and enterprises of the city and region.

### **2. Practice objectives**

- professional orientation of students, formation of a complete understanding of their profession;
- fostering responsibility and independence in the performance of duties in primary positions in the field of application of modern mathematical methods and information technologies;
- development of practical skills in organizing work in the field of application of modern mathematical methods and information technologies, writing scientific publications, inventions, abstracts of presentations at conferences of various levels, preparation of scientific documentation.

### **3. The place of practice in the structure of the educational program**

Place of practical training in the structure of the educational program of higher education: B2.O.01(U) educational practical training Research work (acquisition of primary skills in research work) is based on knowledge and mastery of the materials of the following disciplines of Block 1 of the curriculum of this area of training:

- Methodology of scientific research;
- Project management in the professional field.

### **4. Place and time of the internship**

Type of practice – educational;

Type of practice – research work (acquiring basic skills in research work);

The form of the practice is discrete.

In accordance with the curriculum, the educational practice of Scientific Research Work (acquiring primary skills of scientific research work) is carried out in the first year in the 3 semester.

Internship locations:

- Department of Computational Mathematics and Cybernetics;
- scientific divisions of the university;

### **5. List of planned practical results, correlated with the planned results of mastering the educational program**

| <b>Code, formulation of competence</b> | <b>Code, indicator formulation</b> | <b>Planned results characterizing the stages of formation of competencies, indicators</b> |
|----------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------|
|----------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------|

| <b>Code, formulation of competence</b>                                                                                                                                | <b>Code, indicator formulation</b>                                                                                                                                                                                                                                                                                                                  | <b>Planned results characterizing the stages of formation of competencies, indicators</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UK-2 is capable of managing a project at all stages of its life cycle.                                                                                                | ID-1 UK-2 As part of the project activities, it models the technological processes of creation and processing of materials taking into account economic factors and in accordance with the requirements of environmental and industrial safety<br>ID-2 UK-2 Implements a new project into production and manages it at all stages of its life cycle | As part of the project activities, it models technological processes for the creation and processing of materials, taking into account economic factors and in accordance with environmental and industrial safety requirements.<br>Implements a new project into production and manages it at all stages of its life cycle<br>project activities model technological processes for the creation and processing of materials, taking into account economic factors and in accordance with environmental and industrial safety requirements |
| UK-3 Able to organize and manage the work of a team, developing a team strategy to achieve the set goal.                                                              | ID-1 UK-3 Manages the production activities of employees<br>ID-2 UK-3 Prepares and presents presentations of plans and results of personal and team activities                                                                                                                                                                                      | Manages the production activities of employees<br>Prepares and presents plans and results of personal and team activities                                                                                                                                                                                                                                                                                                                                                                                                                  |
| OPK-1 Capable of finding, formulating and solving current and significant problems in applied and computer mathematics                                                | ID-1 OPK-1 Finds and formulates significant problems of applied and computer mathematics.<br>ID-2 OPK-1 knows and uses methods for solving significant problems of applied and computer mathematics.                                                                                                                                                | Finds and formulates significant problems of applied and computer mathematics.<br>Knows and uses methods to solve significant problems in applied and computer mathematics.                                                                                                                                                                                                                                                                                                                                                                |
| OPK-2 is capable of creating and exploring new mathematical models in the natural sciences, improving and developing concepts, theories and methods                   | ID-1 OPK-2 Conducts research into new mathematical models in the natural sciences<br>ID-1 OPK-2 Develops new and improves existing concepts, theories and methods                                                                                                                                                                                   | Conducts research into new mathematical models in the natural sciences<br>Develops new and improves existing concepts, theories and methods                                                                                                                                                                                                                                                                                                                                                                                                |
| OPK-3 is capable of independently creating application software based on modern information technologies and network resources, including domestically produced ones. | ID-1 OPK-3 Independently creates application software products<br>ID-2 OPK-3 Knows and can find modern information technologies, including domestically produced ones, necessary for the                                                                                                                                                            | Independently creates application software products<br>Knows and is able to find modern information technologies, including domestically produced ones, necessary for the creation of applied software products                                                                                                                                                                                                                                                                                                                            |

| <b>Code, formulation of competence</b> | <b>Code, indicator formulation</b>    | <b>Planned results characterizing the stages of formation of competencies, indicators</b> |
|----------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------|
|                                        | creation of applied software products |                                                                                           |

## **6. Structure and content of the practice**

The total workload of the educational practice – scientific research work (acquiring primary skills in scientific research work) is 6 credit units, 216 hours.

| <b>Sections (stages) of practice</b> | <b>Implemented competencies/ indicators</b> | <b>Types of educational work in practice, including independent work of students</b>                                                                                                                                                                                              | <b>Labor intensity (hour.)</b> | <b>Forms of current control</b> |
|--------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|
| Preparatory                          | UK-2 UK-3<br>OPK-2                          | Study of regulatory and technical documentation, educational and methodological materials. Introduction to the specifics of scientific research activities.                                                                                                                       | 54                             | Interview<br>Knowledge Test     |
| Functional - activity                | UK-2 UK-3<br>OPK-1 OPK-2<br>OPK-3           | Collection, processing, systematization and analysis of factual and literary material for the organization of scientific research activities, completion of educational assignments. Preparation, presentation of scientific articles and testing of scientific research results. | 126                            | Written report<br>Diary         |
| Final                                | UK-2 UK-3<br>OPK-1 OPK-2<br>OPK-3           | Preparation, execution and defense of the report.                                                                                                                                                                                                                                 | 36                             | Writing interview report        |
| <b>Total:</b>                        |                                             |                                                                                                                                                                                                                                                                                   | <b>216</b>                     |                                 |

## **7. Guidelines for students on completing their internship**

### **7.1. Using the material of the educational and methodological complex of practice**

At the first stage, it is necessary to familiarize yourself with the structure of the internship, mandatory types of work and reporting forms, which are reflected in the Methodological Guidelines for the Organization and Conduct of the Internship, developed at the Department of Computational Mathematics and Cybernetics.

To successfully complete the tasks of the academic research work practice (acquiring primary research work skills), the student must independently and thoroughly study the following sources of literature:

| Item No. | Type of independent work                                                             | Recommended sources of information (Source No.) |            |                |                    |
|----------|--------------------------------------------------------------------------------------|-------------------------------------------------|------------|----------------|--------------------|
|          |                                                                                      | Main                                            | Additional | Methodological | Internet resources |
| 1        | Collection, processing and systematization of factual and literary material          | 1-3                                             | 1-3        | 1              | 1-7                |
| 2        | Execution of calculation tasks                                                       | 1-3                                             | 1-3        | 1              | 1-7                |
| 3        | Exploring packages applied programs «MathCAD», «Excel», «Electronics Workbench» etc. | 1                                               | 2          | 1              | 1-7                |

## 7.2 Fund of assessment tools for practice

The Assessment Toolkit (AT) for Academic Internship Research (acquiring basic research skills) is based on a list of acquired competencies, indicating the stages of their development during the internship. The AT provides objective monitoring of the achievement of planned learning outcomes. The AT includes:

- description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales;
- methodological materials defining the procedures for assessing knowledge, skills, abilities and (or) work experience, characterizing the stages of competence development;
- standard test assignments and other materials necessary for assessing knowledge, skills and the level of mastery of the competencies being developed during the internship.

FOS is an appendix to this practice program.

## 8. Educational, methodological and informational support for practice

### 8.1. Recommended literature.

#### 8.1.1. Main literature:

1. Computer networks [Electronic resource]: textbook / V.G. Kartashevsky [et al.]. - Electronic text data. - Samara: Volga Region State University of Telecommunications and Informatics, 2016. - 267 p. - 2227-8397. Access mode: <http://www.iprbookshop.ru/71846.html>
2. Modular Arithmetic and Its Applications in Infocommunication Technologies: [monograph] / N. I. Chervyakov et al. - Moscow: FIZMATLIT, 2017. - 400 p.: ill., table, port. - Bibliography at the end of the section. - ISBN 978-5-9221-1716-6
3. Barsky A.B. Introduction to neural networks [Electronic resource] / A.B. Barsky. - Electronic text data. - M.: Internet University of Information Technologies (INTUIT), 2016. - 358 p. - 2227-8397. Access mode: <http://www.iprbookshop.ru/52144.html>

#### 8.1.2. Further reading:

1. Application of artificial neural networks and residual class systems in cryptography / N. I. Chervyakov [et al.]. - M.: FIZMATLIT, 2012. - 280 p.: ill., app. - ISBN 978-5-9221-1386-1
2. Astanina S. Yu. Research work of students (modern requirements, problems and their solutions) [Electronic resource]: monograph / S. Yu. Astanina, N. V. Shestak, E. V. Chmykhova. -

Electronic text data. - М .: Modern Humanitarian Academy, 2012. - 156 p. - 978-5-8323-0832-6.  
Access mode: <http://www.iprbookshop.ru/16934.html>

### **8.1.3. Methodological literature :**

1. Methodological recommendations for educational practice - research work (acquiring primary skills in research work) for the direction 02.04.01 Mathematics and computer science.

### **8.1.4. Internet resources:**

1. [https://ru.wikipedia.org/wiki/Список\\_оптика](https://ru.wikipedia.org/wiki/Список_оптика) List of operating systems
2. <http://www.intuit.ru/studies/courses/1089/217/info> Fundamentals of Microsoft Operating System Organization Windows
3. <http://www.osp.ru> ( published by Open Systems)
4. <http://www.computer-museum.ru> (Weekly PC- week RE and virtual computer museum).
5. <https://ru.wikipedia.org/wiki> Wikipedia, the free encyclopedia.
6. <http://www.allmath.ru/> All mathematics - higher mathematics, applied mathematics, mathematical methods in economics, financial mathematics
7. <http://www.exponenta.ru/> Educational mathematics website.

### **8.2 Software:**

1. Microsoft Visual Studio Community with CUDA module ( In free access )
2. Microsoft Visual Studio Code (Open Source)
3. Microsoft Visio Standard 2013 agreement 01- ea / 13 dated February 25, 2013
4. DBDesigner 4 (Free)
5. Microsoft Visual Studio Community ( In free access )
6. Microsoft SQL Server 2012 Express (Freely Available)

## **9. Logistics for the internship**

The premises are classrooms for conducting classes provided for by the master's degree program, equipped with equipment and technical teaching aids, the composition of which is determined in the working programs of the disciplines (modules).

The rooms for independent student work are equipped with computers with the ability to connect to the Internet and provide access to the Organization's electronic information and educational environment.

The organization is provided with the necessary set of licensed and freely distributed software, including domestically produced ones.

Students are provided with access (remote access), including in the case of the use of e-learning and distance learning technologies, to modern professional databases and information reference systems, the composition of which is determined in the working programs of disciplines (modules) and is subject to updating as necessary).

## **10. Peculiarities of mastering practice by individuals with disabilities**

Students with disabilities are provided with special textbooks, teaching aids and didactic materials, special technical teaching aids for collective and individual use, the services of an assistant (helper) who provides students with the necessary technical assistance, as well as the services of sign language interpreters and tactile sign language interpreters .

Internships for students with disabilities can be organized together with other students, as well as in separate groups.

The internship of students with disabilities is carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status.

In order to ensure accessibility of higher education under the educational program for individuals with disabilities during their internship, the following is provided:

1) for persons with visual impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),
- written assignments, as well as instructions on how to complete them, are written in large print,
- special textbooks, teaching aids and didactic materials (with large print or audio files),
- individual uniform illumination of at least 300 lux,
- if necessary, the student is provided with a magnifying device to complete the assignment;

2) for persons with hearing impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),
- the availability of sound amplification equipment for collective use is ensured; if necessary, the student is provided with sound amplification equipment for individual use;
- is provided with appropriate sound means for reproducing information;

3) for persons with disabilities who have musculoskeletal disorders (including severe impairment of the motor functions of the upper limbs or the absence of upper limbs):

- written assignments are completed on a computer with specialized software or dictated to an assistant;
- at the student's request, assignments can be completed orally