

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

**Industrial Internship Program**  
Pre-graduation Internship / Преддипломная практика

|                                 |                                             |
|---------------------------------|---------------------------------------------|
| 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       | 4                                           |

**Developed by**

Head of the Department of Computational  
Mathematics and Cybernetics , Doctor of  
Physical and Mathematical Sciences, Associate  
Professor  
Babenko M.G.

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## **1. Objectives of the practice**

The objectives of the industrial practice are Pre-graduation Internship / Преддипломная практика in the field of study 02.04.01 Mathematics and computer science, focus (profile) «Training Program for Electronic Information» are: consolidation and deepening of theoretical knowledge;

- solving mathematical problems corresponding to qualifications that arise during scientific and applied research;
- preparation of reviews, annotations, compilation of abstracts and bibliographies on the topics of the research being conducted;
- participation in seminars, conferences, design and preparation of publications based on the results of ongoing research work;
- 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**

The objectives of the practice are:

- design, organization, implementation and evaluation of the results of scientific research in the field of applied mathematics using modern scientific methods, as well as information and innovative technologies;
- organizing interaction with colleagues in solving current research problems;
- using the existing capabilities of the educational environment and designing new conditions, including informational ones, to solve scientific research problems;
- implementation of professional and personal self-education, planning of further educational route and professional career, participation in experimental work;
- application of mathematical and algorithmic modeling methods in the analysis of applied problems;
- the use of basic mathematical problems and mathematical methods in scientific research;
- solving applied problems in the field of secure information and telecommunication technologies and systems;
- use of technologies and computer systems for facility management

## **3. The place of practice in the structure of the educational program 02.04.01 Mathematics and Computer Science**

Place of practice in the structure of the educational program of higher education: Industrial practice B2.O.02 ( Pd ), 4th semester, 8 weeks.

Industrial practice, in accordance with the federal state educational standard, is mandatory and represents a form of organization of the educational process directly focused on the professional and practical training of students.

The practice is based on the following disciplines and types of practice: operational practice, scientific research, scientific research methodology.

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

Type of practice – industrial;

Type of practice – pre-graduation practice;

The form of the practice is discrete.

- internship B2.O.02 ( Pd ) is conducted in accordance with the curriculum. It takes place in the fourth semester and lasts eight weeks. The internship is conducted at enterprises designated by the North Caucasus Federal University and having signed an agreement on practical training. The selected enterprises are those with specific experience in mathematics and computer science and using new information technologies, as well as teaching laboratories from the university's departments, primarily the graduate department.

- scientific divisions of the university;

- OJSC "Concern Energomera "
- OJSC " SevKavNIPIgaz "
- OOO "Computer Union".

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

| Code, formulation of competence                                                                                                             | Code, indicator formulation                                                                                                                                                                                                                                                                                                                                                                                                       | Planned results characterizing the stages of formation of competencies, indicators                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Capable of carrying out a critical analysis of problematic situations based on a systems approach and developing an action strategy (UK-1). | ID-1 <sup>UK-1</sup> Selects information resources for searching for information in accordance with the assigned educational task.<br>ID-2 <sup>UK-1</sup> Systematizes information obtained from various sources in accordance with the requirements for completing the educational assignment.<br>ID-3 <sup>UK-1</sup> Formulates and argues conclusions and judgments, including using the philosophical conceptual apparatus. | Selects information resources to search for information in accordance with the assigned educational task.<br>Systematizes information obtained from various sources in accordance with the requirements of the educational task.<br>Formulates and argues conclusions and judgments, including using philosophical conceptual apparatus. |
| Able to determine and implement priorities of one's own activities and ways to improve them based on self-assessment (UK-6).                | ID-1 <sup>UK-6</sup> Ready for self-development, self-realization, and use of creative potential<br>ID-2 <sup>UK-6</sup> Defines and implements priorities of own activities                                                                                                                                                                                                                                                      | Ready for self-development, self-realization, and the use of creative potential<br>Defines and implements priorities for own activities                                                                                                                                                                                                  |
| Able to conduct scientific research based on existing methods in a specific area of professional activity (PC-2).                           | ID-1 <sup>PC-2</sup> Conducts scientific research in the field of parallel computer technologies.<br>ID-2 <sup>PC-2</sup> Conducts review of scientific articles, abstracts and dissertations in the fields of mathematics and information technology                                                                                                                                                                             | Conducts scientific research in the field of parallel computer technologies.<br>Conducts reviews of scientific articles, abstracts and dissertations in the fields of mathematics and information technology                                                                                                                             |
| Capable of conducting methodological and expert work in the field of mathematics and computer science (PC-3).                               | ID-1 <sup>PC-3</sup> Conducts expert work in mathematics.<br>ID-2 <sup>PC-3</sup> Conducts expert work in the field of computer science<br>ID-2 <sup>PC-3</sup> Prepares methodological materials in the field of mathematics and computer science                                                                                                                                                                                | Conducts expert work in mathematics.<br>Conducts expert work in the field of computer science<br>Prepares teaching materials in the fields of mathematics and computer science                                                                                                                                                           |
| Capable of conducting patent research, determining forms and methods of legal                                                               | ID-1 <sup>PC-4</sup> Makes a rational choice of methods for protecting intellectual property rights;<br>ID-2 <sup>PC-4</sup> Conducts patent research                                                                                                                                                                                                                                                                             | Makes rational choices regarding methods of protecting intellectual property rights;                                                                                                                                                                                                                                                     |

|                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| protection and defense of rights to the results of intellectual activity, and managing rights to them to solve problems in the field of development of science, engineering and technology (PC-4). | in the field of computing and communication systems.                                                                                                                                                                                                                                                       | Conducts patent research in the field of computing and communication systems.                                                                                                                                                                                      |
| Able to use modern methods of developing and implementing specific algorithms for mathematical models based on programming languages and application packages for modeling (PC- 6 ).               | ID-1 PC- 6 Using modern packages of applied modeling software, it explores newly created mathematical models;<br>ID-2 PC- 6 Uses modern methods for developing algorithms for mathematical models<br>ID-3 PC- 6 Uses modern programming languages to implement specific algorithms and mathematical models | Using modern software packages for modeling, it explores newly created mathematical models;<br>Uses modern methods for developing algorithms for mathematical models<br>Uses modern programming languages to implement specific algorithms and mathematical models |

## 6. Structure and content of the practice

The total workload of industrial practice – pre-graduation practice is 12 credit units, 432 hours.

| Sections (stages) of practice | Implemented competencies /indicators         | Types of educational work in practice, including independent work of students                                  | Labor intensity (hour.) | Forms of current control |
|-------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------|
| Preparatory                   | UK-1<br>UK-6                                 | Industrial instruction, safety instruction.                                                                    | 4                       | Written report           |
|                               |                                              | Study of normative and technical documentation of educational and methodological materials.                    | 8                       | Knowledge test           |
| Functional-activity           | UK-1<br>UK-6<br>PC-2<br>PC-3<br>PC-4<br>PC-6 | Collection, processing and systematization of factual and literary material, completion of diploma assignments | 376                     | Written report<br>Diary  |
| Final                         | UK-1<br>UK-6<br>PC-4<br>PC-6                 | Preparation, execution and defense of the report.                                                              | 40                      | Written report           |
|                               |                                              | Passing the practical test.                                                                                    | 4                       | Written report           |
| Total:                        |                                              |                                                                                                                | 432                     |                          |

## 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 internship developed by the department.

To successfully complete the practical assignments for industrial practice (Pre-graduation Internship / Преддипломная практика), the student must independently and thoroughly study the following sources of literature:

| Type of independent work                                                            | Recommended sources of information (Source No.) |            |                |                    |
|-------------------------------------------------------------------------------------|-------------------------------------------------|------------|----------------|--------------------|
|                                                                                     | Main                                            | Additional | Methodological | Internet resources |
| Collection, processing and systematization of factual and literary material         | 1-3                                             | 1-2        | 1              | 1-7                |
| Completion of diploma assignments within the framework of the chosen research area. | 1-3                                             | 1-2        | 1              | 1-7                |

## 7.2 Fund of assessment tools for practice

The assessment toolkit (AST) for industrial internships is based on a list of competencies to be mastered, indicating the stages of their development during the internship. The AST provides objective monitoring of the achievement of planned learning outcomes. The AST 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. 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

#### 8.1.2. Further reading:

1. Alan Oppenheim Digital Signal Processing [Electronic resource] / Oppenheim Alan, Shafer Ronald. - Electronic text data. - Moscow: Technosfera, 2012. - 1048 p. - 978-5-94836-329-5. Access mode: <http://www.iprbookshop.ru/26906.html>

2. Shtarkov Yu. M. Universal Coding: Theory and Algorithms [Electronic resource] / Moscow: Fizmatlit, 2013. - 280 p. - 978-5-9221-1517-9. Access mode: [http://biblioclub.ru/index.php?page=book\\_red&id=275569](http://biblioclub.ru/index.php?page=book_red&id=275569)

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

1. Methodological recommendations for industrial (pre-graduation) practice for the direction 02.04.01 Mathematics and computer science.

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

1. [https://ru.wikipedia.org/wiki/Список\\_операционных\\_систем](https://ru.wikipedia.org/wiki/Список_операционных_систем) 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/](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. MathWorks MATLAB Builder EX, MATLAB Builder JA Agreement No. 130- ea / 13 dated November 28, 2013 .
5. DBDesigner 4 (Free)
6. Microsoft Visual Studio Community ( In free access )
7. 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