

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 Mathemat-  
ical Sciences, Associate Professor  
Grobova T.A.

**WORKING PROGRAM OF THE DISCIPLINE:**

Big Data Analysis and Mining / Анализ и обработка больших данных

|                                 |                                             |
|---------------------------------|---------------------------------------------|
| 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       | 2                                           |

**Developed by**

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### 1. The purpose and objectives of mastering the discipline

**The purpose of the course** : to develop general professional competencies of future master's students in the field of study 02.04.01 Mathematics and computer science .

#### **Objectives of the discipline :**

- development of professional knowledge, skills and abilities in using mathematical apparatus, programming methodology and modern computer technologies to solve practical problems of obtaining, storing, processing and transmitting information;
- fostering a mathematical culture that implies a clear understanding of the necessity and importance of mathematical training for a specialist in the field of computer science;
- familiarization with the main objects of numerical methods, as well as their applications for solving various problems requiring the use of such tools

### 2. The place of the discipline in the structure of the educational program

The course "Big Data Analysis and Mining / Анализ и обработка больших данных" is a mandatory part of the curriculum. It is taught in the 5th and 6th semesters.

### 3. A list of planned learning outcomes for the discipline, correlated with the planned learning outcomes for the educational program

| Code, formulation of competence                                                                                                                     | Code, indicator formulation                                                                  | Planned learning outcomes for the discipline (module), characterizing the stages of formation of competencies, indicators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OPK-2 is capable of creating and exploring new mathematical models in the natural sciences, improving and developing concepts, theories and methods | ID-1 <sub>OPK-2</sub> Conducts research into new mathematical models in the natural sciences | Conducting research into new mathematical models applied to big data analysis tasks; formulating a research problem based on the structure, volume, quality, and characteristics of the source data; selecting mathematical models for solving problems of classification, regression, clustering, searching for association rules, detecting anomalies, and analyzing streaming data; studying the properties of data mining models taking into account the requirements of scalability, stability, interpretability, and reproducibility; assessing the quality of mathematical models based on relevant metrics; comparing alternative models and methods for big data analysis; identifying the limitations of the models used when working with large, heterogeneous, and dynami- |

|                                                                                                                       |                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                       |                                                                                                    | cally changing datasets; formulating substantiated conclusions on the applicability of the studied mathematical models to big data analysis and mining tasks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                       | ID-2 <sub>OPK-2</sub> Develops new and improves existing concepts, theories and methods            | Developing new and improving existing concepts, theories, and methods applied to big data analysis; analyzing modern approaches to distributed storage, processing, and intellectual analysis of big data; identifying the limitations of existing methods of classification, regression, clustering, association rule mining, anomaly detection, and stream data analysis; improving methods for preparing, transforming, and selecting features, taking into account the structure, volume, quality, and dynamics of the source data; developing and justifying options for modifying algorithms and models to improve the quality, scalability, stability, and reproducibility of analysis results; comparing alternative concepts and methods of Big Data Analysis and Mining based on objective criteria of quality and computational efficiency; formulating proposals for adapting existing methods to large, heterogeneous, and dynamically changing datasets; substantiating the applicability of developed or improved approaches to solving research and applied problems of big data analysis . |
| PC-6. Able to use modern methods for developing and implementing specific algorithms for mathematical models based on | ID-1 <sub>PC-6</sub> Using modern packages of applied modeling programs, it explores newly created | Study of newly created mathematical models using modern application packages for modeling; selection of software tools for imple-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>programming languages and application packages for modeling.</p> |                                                                                                  | <p>mentation and testing of models in big data analysis tasks; application of Hadoop, Apache Spark, PySpark, Spark SQL, Spark MLlib and other distributed data processing tools for conducting computational experiments; preparation of large data sets for modeling, including cleaning, transformation, aggregation and formation of features; implementation of models of classification, regression, clustering, search for association rules, anomaly detection and analysis of stream data using modern software packages; tuning of model parameters and conducting an experimental study of their behavior on various data sets; assessment of the quality, stability, scalability and computational efficiency of the studied models; analysis of modeling results and identification of limitations of the applied software tools; formulation of substantiated conclusions on the applicability of the studied mathematical models and application packages to the tasks of Big Data Analysis and Mining.</p> |
|                                                                     | <p>ID-2<sub>PC-6</sub> Uses modern methods for developing algorithms for mathematical models</p> | <p>Using modern methods for developing algorithms for mathematical models in big data analysis problems; selecting an algorithmic approach taking into account the structure, volume, quality and dynamics of the source data; developing algorithms for pre-processing, filtering, aggregation, joining, transformation and feature selection for large data sets; applying distributed and parallel processing</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                       | <p>methods in implementing algorithms for mathematical models; developing algorithms for classification, regression, clustering, searching for association rules, anomaly detection and analysis of streaming data; adapting existing algorithms to the conditions of scalable data processing in the Hadoop and Apache Spark environments; assessing the computational complexity, performance, stability and reproducibility of the developed algorithms; comparing alternative algorithmic solutions based on the quality of results and processing efficiency; justifying the choice of methods for developing algorithms for mathematical models to solve Big Data Analysis and Mining problems.</p>   |
| <p>ID-3<sub>PC-6</sub> Uses modern programming languages to implement specific algorithms and mathematical models</p> | <p>Using modern programming languages to implement specific algorithms and mathematical models in Big Data analysis tasks; selecting a programming language, programming interface, and library taking into account the specifics of the problem being solved, the volume of data, and the requirements for distributed processing; using Python, PySpark, Spark SQL, Spark MLlib, and other modern tools for software implementation of Big Data Analysis and Mining algorithms; developing software solutions for loading, cleaning, filtering, aggregating, joining, and transforming large data sets; implementing algorithms for classification, regression, clustering, searching for association</p> |

|  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | rules, anomaly detection, and analyzing streaming data; building software pipelines for preparing features, training models, and evaluating the quality of the results; debugging, testing, and verifying the correctness of the implemented algorithms; analyzing the performance, scalability, and reproducibility of the software implementation; interpreting the results of the implemented mathematical models and justifying the applicability of the selected programming languages and software tools to Big Data Analysis and Mining tasks. |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4. Volume of the academic discipline and forms of control \*

|                                                                 |                           |
|-----------------------------------------------------------------|---------------------------|
| Number of classes: total: <b>3 credits, 108</b> academic hours. | OFO,<br>in academic hours |
| <b>Contact work:</b>                                            | <b>32.00</b>              |
| Lectures/including practical training                           | 0.00                      |
| Laboratory work /including practical training                   | 32.00                     |
| Practical classes /including practical training                 | 0                         |
| <b>Independent work</b>                                         | <b>76.00</b>              |
| <b>Forms of control</b>                                         | -                         |
| Exam                                                            | -                         |
| Credit 2 semester                                               | -                         |
| Credit with grade                                               | -                         |
| Coursework                                                      | No                        |

\* The course involves the use of e-learning and distance learning technologies

### 5. The content of the discipline, structured by topics (sections) indicating the number of hours and types of classes

| No.          | Section (topic) of the discipline and brief content | Formed competencies, indicators                                                                | full-time education                                                              |                   |                 |                         | Forms of ongoing monitoring of academic performance |
|--------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------|-----------------|-------------------------|-----------------------------------------------------|
|              |                                                     |                                                                                                | Contact work students with teacher/of which in uniform practical training, hours |                   |                 | Independent work, hours |                                                     |
|              |                                                     |                                                                                                | Lectures                                                                         | Practical classes | Laboratory work |                         |                                                     |
| 2nd semester |                                                     |                                                                                                |                                                                                  |                   |                 |                         |                                                     |
| 1.           | Deploying a training environment for Big Data       | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |                                                                                  | 2.00              |                 | 7:00                    | Defense of laboratory work                          |
| 2.           | Working with HDFS: Big Data File System             | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |                                                                                  | 2.00              |                 | 7:00                    | Defense of laboratory work                          |
| 3.           | Analysis of the data storage structure in HDFS      | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |                                                                                  | 2.00              |                 | 7:00                    | Defense of laboratory work                          |
| 4.           | Classic MapReduce model                             | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |                                                                                  | 2.00              |                 | 7:00                    | Defense of laboratory work                          |

|     |                                                 |                                                                                                |  |      |  |      |                            |
|-----|-------------------------------------------------|------------------------------------------------------------------------------------------------|--|------|--|------|----------------------------|
| 5.  | Processing Structured Data with Hadoop          | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 6.  | Introduction in Apache Spark and PySpark        | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 7.  | RDD: Basic Transformations and Actions          | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 8.  | Spark DataFrame API                             | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 9.  | Spark SQL and Analytical Query Execution        | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 10. | Data storage formats: CSV, JSON, Parquet        | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 11. | Joins, Groupings, and Window Functions in Spark | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |
| 12. | Optimizing Spark Applications                   | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00 |  | 7:00 | Defense of laboratory work |

|     |                                                                   |                                                                                                |  |              |  |           |                            |
|-----|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--|--------------|--|-----------|----------------------------|
| 13. | Building a batch data processing pipeline                         | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00         |  | 7:00      | Defense of laboratory work |
| 14. | Structured Streaming in Apache Spark                              | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00         |  | 7:00      | Defense of laboratory work |
| 15. | Data Mining on Spark: Classification and Model Quality Assessment | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00         |  | 7:00      | Defense of laboratory work |
| 16. | Data Mining on Spark: Clustering and Association Rule Discovery   | ID-1 <sub>OPK-2</sub><br>ID-2 <sub>OPK-2</sub><br>ID-1 <sub>PC-6</sub><br>ID-1 <sub>PC-6</sub> |  | 2.00         |  | 7:00      | Defense of laboratory work |
|     | <b>TOTAL for 2nd semester</b>                                     |                                                                                                |  | <b>32.00</b> |  | <b>76</b> |                            |
|     | <b>TOTAL</b>                                                      |                                                                                                |  | <b>32.00</b> |  | <b>76</b> |                            |

## **6. Fund of assessment tools for the discipline**

The Assessment Toolkit (AT) for the course "Big Data Analysis and Mining / Анализ и обработка больших данных" is based on a list of mastered competencies, indicating the stages of their development during the course. 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 developed competencies in the process of mastering the discipline (module).

FOS is an appendix to this discipline program.

## **7. Methodological guidelines for students on mastering the discipline**

When starting work, each student should take into account the following provisions.

The course "Analysis and Processing of Big Data" is structured thematically, with each topic representing a logically complete section.

Practical work is aimed at acquiring practical experience in the relevant subject area .

Students' independent work is aimed at independent study of additional material, preparation for practical and laboratory classes, and completion of all types of independent work.

To successfully master the discipline, it is necessary to complete all types of independent work using the recommended sources of information.

## **8. Educational, methodological and informational support of the discipline**

### **8.1. List of basic and additional literature required for mastering the discipline**

#### **8.1.1. List of main literature:**

1. Zenkov A.V. Numerical methods: textbook / A.V. Zenkov. - Ekaterinburg: Publishing house of the Ural. University, 2016. - 124 p.

2. Kalitkin, N. N. Numerical Methods: A Textbook / N. N. Kalitkin; edited by A. A. Samarskii. - 2nd ed. - St. Petersburg: BHV-Petersburg, 2014. - 586 p.: ill. - (Educational Literature for Universities). - Approved by the Scientific and Methodological Council. - Bibliography: pp. 575-581 (129 titles). - Subject index: pp. 582-586. (10 copies): [Electronic resource].

#### **8.1.2. List of additional literature:**

1. Kireev V. I. Numerical methods in examples and problems: [a textbook for university students studying in the field of "Applied Mathematics"] / V. I. Kireev, A. V. Panteleev. - 4th ed., corrected. - St. Petersburg [and others]: Lan, 2015. - 448 p.

2. Pirumov, U. G. Numerical Methods: Theory and Practice: A Textbook for Bachelors / U. G. Pirumov; Moscow Aviation Institute (National Research University). - 5th ed., revised and enlarged. - Moscow: Yurait, 2012. - 421 p. - (Bachelor. Basic Course). - Stamp: Add. MO. - Bibliography: p. 416.

3. Srochko V. A. Numerical methods: a lecture course: [for students of higher educational institutions studying in the specialty 010200 "Applied Mathematics and Computer Science" and in the direction 510200 "Applied Mathematics and Computer Science"] / V. A. Srochko. - St. Petersburg [and others]: Lan, 2016. -- 208 p.

### **8.2. List of educational and methodological support for independent work of students in the discipline**

1. Guidelines for completing laboratory work on the subject " Analysis and processing of big data" (electronic resource)

2. Guidelines for organizing and conducting independent work on the subject "Analysis and processing of big data" (electronic resource)

### **8.3. List of resources of the information and telecommunications network "Internet" necessary for mastering the discipline**

1. Bazhenova I.Yu. Introduction to programming [Electronic resource]: textbook / I.Yu. Bazhenova, V.A. Sukhomlin. - Electronic text data. - Moscow, Saratov: Internet University of Information Technologies (INTUIT), University education, 2017. - 327 p. - URL : <http://www.iprbookshop.ru/67397.html>

2. Ivanov A.P., Poznyak L.T. Workshop on numerical methods. Calculation functions . URL: <http://www.apmath.spbu.ru/ru/structure/depts/is/task1-2013.pdf> .

3. Pimenov V.G. Numerical Methods: in 2 parts. Part 2: [study guide] / V.G. Pimenov, A.B. Lozhnikov; [scientific ed. Yu.A. Melentsova] ; Ministry of Education and Science of the Russian Federation, Ural. Federal University. – Ekaterinburg: Publishing house of Ural. University, 2014. – 106 p. – URL: [https://elar.urfu.ru/bitstream/10995/31219/1/978-5-7996-1342-6\\_2014.pdf](https://elar.urfu.ru/bitstream/10995/31219/1/978-5-7996-1342-6_2014.pdf) .

4. Numerical Methods . Part 1. URL : <https://teach-in.ru/course/numerical-methods-part-1>

### **9. List of information technologies used in the implementation of the educational process in the discipline, including a list of software and information reference systems**

Lectures are delivered using computers and multimedia presentations. In lab classes, students present presentations they prepared during independent work hours.

Information reference systems:

Information and reference and information and legal systems used in the study of the discipline:

|    |                                                                                                                                                                        |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <a href="https://ru.wikipedia.org/wiki/">https://ru.wikipedia.org/wiki/</a> Computational_methods Wikipedia is the free encyclopedia.                                  |
| 2. | <a href="http://www.intuit.ru/studies/courses/2317/617/info">http://www.intuit.ru/studies/courses/2317/617/info</a> Numerical methods: National Open University INTUIT |

Software:

|   |                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------|
| 1 | Operating system: Microsoft Windows (latest version)                                                            |
| 2 | Base plastic bag Microsoft Office programs (Word, Excel, PowerPoint)                                            |
| 3 | Maple Microsoft Office Standard 2013 ( agreement No. 01- ea / 13 dated February 25, 2013, license No. 61541869) |

### **10. Description of the material and technical base necessary for the implementation of the educational process in the discipline**

|                   |                                                                                                                                                                                        |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Practical classes | A classroom for conducting classes, equipped with multimedia equipment and technical teaching aids                                                                                     |
| Independent work  | A room for independent student work equipped with computers and the ability to connect to the Internet and access the university's electronic information and educational environment. |

### **11. Features of mastering the discipline by persons 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.

The acquisition of the discipline by students with disabilities can be organized jointly with other students, as well as in separate groups.

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

In order to ensure accessibility of higher education under the educational program for individuals with disabilities, the following is provided when mastering the discipline:

- 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 impairments 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.

## **12. Features of the implementation of the discipline using distance learning technologies and e-learning**

According to Part 1 of Article 16 of Federal Law No. 273-FZ of December 29, 2012, "On Education in the Russian Federation," *e-learning* is defined as the organization of educational activities using information contained in databases and used in the implementation of educational programs, as well as information technologies, technical means, and information and telecommunications networks that facilitate the transmission of said information over communication lines, as well as interaction between students and teaching staff. *Distance learning technologies* are educational technologies implemented primarily using information and telecommunications networks through indirect (remote) interaction between students and teaching staff.

The course may be delivered using distance learning technologies and e-learning, in whole or in part. The components of the course's teaching and methodological kit (the course curriculum, assessment and methodological materials, and assessment forms) implemented using distance learning technologies and e-learning contain instructions for their use.

When organizing educational activities using distance learning technologies and e-learning, asynchronous and synchronous methods of interaction between participants in educational relations may be provided through the Internet information and telecommunications network.

When using distance learning technologies and e-learning, the following is indicated in the curriculum for the discipline:

methods for implementing interaction between participants in educational relations through the information and telecommunications network "Internet" (VKS - video conferencing, ET - electronic testing);

links to the electronic information and educational environment of SKFU, to educational platforms and resources of other organizations, to which open access is provided through the information and telecommunications network "Internet";

for synchronous learning - time of online classes and teachers;

For asynchronous learning - online course authors.

When organizing midterm assessments using distance learning technologies and e-learning, the Methodological Recommendations for the Use of Technical Means Ensuring the Objectivity of Results during Midterm and State Final Assessments for Higher Education Programs—Bachelor's Degree Programs, Specialist Programs, and Master's Degree Programs Using Distance Learning Technologies—are used (Letter of the Ministry of Education and Science of Russia dated December 7, 2020, No. MN-19/1573-AN "On the Submission of Methodological Recommendations").

The implementation of the course using e-learning and distance learning technologies is carried out using the electronic information and educational environment of SKFU, to which students have access via the information and telecommunications network "Internet", or using the resources of other organizations, including platforms providing services for video conferencing, online meetings and distance learning (MTS-Link), as well as using the capabilities of social networks for communication between students and teachers.

The educational and methodological support for a discipline implemented using e-learning and distance learning technologies includes a work program, educational and methodological manuals or a course of lectures, methodological instructions for the implementation of various types of educational activities of students provided for by the discipline, and other educational and methodological materials posted in the information and educational environment of SKFU, presented in electronic form.