

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of 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
Grobova T.A.

WORKING PROGRAM OF THE DISCIPLINE

Intelligent Terminal Operating System / Интеллектуальная терминальная операционная
система

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

Associate Professor of the Department of Mathematical
Modeling, Candidate of Technical Sciences, Associate
Professor
Shaposhnikov A.V.

1. The purpose and objectives of mastering the discipline (module)

The aim of the course is to develop students' theoretical knowledge and practical skills in the application of modern operating systems in information systems in various fields of professional activity (industrial production, economics, business, etc.).

The main objective of studying the discipline is to familiarize students with the main trends in the development of operating systems and to acquire practical skills in using modern operating systems in various areas of industrial and commercial activities.

2. The place of the discipline (module) in the structure of the educational program

The discipline "Intelligent Terminal Operating System / Интеллектуальная терминальная операционная система" is one of the compulsory disciplines.

3. List of planned learning outcomes for the discipline (module), 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
PC-4 Capable of conducting patent research, determining forms and methods of legal 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	ID-1 _{PC-4} Makes rational choices regarding methods of protecting intellectual property rights; ID-2 _{PC-4} Conducts patent research in the field of computing and communication systems.	Knows the purpose, composition, functions of operating systems, and mechanisms for managing processes and memory, input-output
PC-5 Able to present and adapt mathematical knowledge, programming methods and information technology in various ways, taking into account the level of the audience	ID-1 _{PC-5} Assesses the level of preparation of listeners during their public speeches ID-2 _{PC-5} Adapts the presentation of mathematical knowledge and programming methods to the level of the students	Can use the API to develop command and batch files
PC-7 Able to create and explore new mathematical models in the natural sciences, industry and business, taking into account the capabilities of modern information technology, programming and computer equipment	ID-1 _{PC-7} With the help of modern information technologies, explores newly created mathematical models in the natural sciences of industry; ID-2 _{PC-7} Conducts Parallel Computer and Network Technologies as part of his professional activities ID-3 _{PC-7} Uses modern programming languages and application software packages to implement	Possesses skills in installation, configuration and operation of modern operating systems

	specific algorithms and mathematical models	
--	---	--

4. Volume of the academic discipline (module) and forms of control *

Amount of classes: total: 4 credits, 144 academic hours.	OFO, in academic hours
Contact work:	
Lectures/including practical training	2
Laboratory work /including practical training	0
Practical classes /including practical training	4
Independent work	84
Forms of control	
Exam in the 3rd semester	54
Credit	-
Credit with grade	-
Coursework	-

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	Developed competencies, indicators	Contact work of students with a teacher/of which in the form of practical training, hours			Independent work, hours	Forms of ongoing monitoring of academic performance
			Lectures	Practical classes	Laboratory work		
1	Introduction to Operating Systems 1. Course structure. Study time. Knowledge, skills, and abilities required of students during the course, as well as the required levels of proficiency. Recommended reading. Reporting. 2. The concept of an operating system. Virtual machines. 3. Operating system, environment and operating shell. 4. Evolution of operating systems.	PC-4 PC-5 PC-7	2.0			5.0	Attendance control, notes, testing
2	Architecture, purpose and functions of operating systems 1. Purpose, composition and functions of operating systems. 2. Operating system architecture. 3. Classification of operating systems. 4. Efficiency and requirements for operating systems.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
3	Organization of the computing process 1. The concept of processes and flows. Task, processes, flows (threads), fibers. 2. Multiprogramming. Forms of multiprogramming work. 3. Process and thread management. 4. Creating processes and threads. Process and thread models. 5. Scheduling tasks, processes and threads.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
4	Memory management 1. Organization of memory of a modern computer. 2. Memory management functions of the operating system. 3. Memory allocation.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
5	Input/output subsystem 1. Input/output devices. 2. Purpose, tasks and technologies of the input-output subsystem. 3. Coordination of data exchange and caching speeds. 4. Sharing devices and data between processes. 5. Providing a logical interface between devices and the system. 6. Support for a wide range of drivers. 7. Dynamic loading and unloading of drivers. 8. Support for synchronous and asynchronous I/O operations.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing

	9. Multilayer (hierarchical) model of the input-output subsystem. 10. Drivers.						
6	File systems 1. File system architecture. 2. Organizing and accessing files. 3. Catalogue systems. 4. Physical organization of the file system. 5. Information structure of magnetic disks. 6. Physical organization and file addressing. 7. Physical organization of the FAT system. 8. File operations. 9. File access control.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
7	Fundamentals and Ensuring Information Security 1. Information security requirements. 2. Classification of security threats. 3. Security requirements for information systems. 4. Doctrine of information security of the Russian Federation.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
8	Prospects for Operating Systems and Networks 1. Operating systems for cloud computing. 2. Trends in the development of modern operating systems. 3. Modern trends in the development of operating systems.	PC-4 PC-5 PC-7				5.0	Attendance control, notes, testing
9	Obtaining the Astra Linux operating system distribution 1. Computer requirements for installing the Astra Linux operating system. 2. Brief description of the Astra Linux operating system. 3. Astra Linux versions. 4. Astra Linux repositories. 5. ALSE security levels.	PC-4 PC-5 PC-7		2.0		5.0	Attendance control, laboratory work protection, testing
10	Installing the Astra Linux operating system on a virtual machine 1. Setting virtual machine parameters. 2. Select language and installation type. 3. Setting up user accounts and passwords. 4. Disk markings. 5. Installing the base system. 6. Installing the system bootloader. 7. Completing the installation.	PC-4 PC-5 PC-7				5.0	Attendance control, laboratory work protection, testing
11	Initial setup of Astra Linux 1. Setting screen resolution 2. Network setup. 3. System update .	PC-4 PC-5 PC-7		2.0		5.0	Attendance control, laboratory work protection , testing
12	Working with the Fly graphical interface 1. Login. 2. Desktop.	PC-4 PC-5				5.0	Attendance control,

	3. File manager. 4. Desktop and Start menu. 5. System monitor. 6. Control Panel.	PC-7					laboratory work protection, testing
13	Working with the terminal and the Bash shell 1. System and virtual consoles. 2. Terminal emulator. 3. Bash command shell.	PC-4 PC-5 PC-7				6.0	Attendance control, laboratory work protection, testing
14	Working with help systems 1. Linux reference systems. 2. Bash shell built-in commands reference. 3. Manual pages of the manpages system. 4. Search for manual pages. 5. Astra Linux Help.	PC-4 PC-5 PC-7				6.0	Attendance control, laboratory work protection, testing
15	Working with files and directories 1. The main differences in working with files. 2. Linux file system structure. 3. Working with files and directories.	PC-4 PC-5 PC-7				6.0	Attendance control, laboratory work protection, testing
16	Working with text information 1. Basic commands for viewing text files. 2. Basic commands for editing texts from the command line. 3. Text editors.	PC-4 PC-5 PC-7				6.0	Attendance control, laboratory work protection, testing
	TOTAL		2	4		84	

6. Fund of assessment tools for conducting ongoing monitoring of academic performance and midterm assessment of students in a discipline (module)

The Assessment Toolkit (AT) for ongoing monitoring of student progress and midterm assessment in the " Intelligent Terminal Operating System / Интеллектуальная терминальная операционная система " course (module) is based on a list of mastered competencies, indicating the stages of their development during the course (module) mastery. 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 (module) program.

7. Methodological guidelines for students on mastering the discipline

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

The discipline (module) is structured on a thematic principle, each topic is a logically complete section.

The lecture material is devoted to the examination of key, basic provisions of the courses and an explanation of the educational assignments assigned to students for independent work.

Practical work is carried out with the aim of consolidating the acquired information and acquiring skills for its application in solving practical problems in the relevant subject area.

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

To successfully master the discipline it is necessary 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 (module)

8.1.1. List of main literature:

1. Vinokurov, I.V. Operating Systems: A Textbook for Bachelors / compiled by I.V. Vinokurov. - Moscow: IPR Media, 2022. - 133 p. - ISBN 978-5-4497-1406-0. - Text: electronic // Digital educational resource IPR SMART: [website]. - URL: <https://www.iprbookshop.ru/115696.html> , unlimited copies
2. Filippov, A.A. Operating systems: a tutorial / A. A. Filippov. - Ulyanovsk: Ulyanovsk State Technical University, 2021. - 100 p. - ISBN 978-5-9795-2129-9. - Text: electronic // Digital educational resource IPR SMART: [site]. - URL: <https://www.iprbookshop.ru/121273.html> , unlimited copies
3. Nazarov, S. V. Modern operating systems: a tutorial / S. V. Nazarov, A. I. Shirokov. - Moscow, Saratov: Internet University of Information Technologies (INTUIT), IPR Media, 2020. - 351 p. - ISBN 978-5-4497-0385-9. - Text: electronic // Digital educational resource IPR SMART: [site]. - URL: <https://www.iprbookshop.ru/89474> , unlimited copies
4. Eliseev, A. I. Fundamentals of Administration and System Programming in the Linux Operating System. In 2 parts / A. I. Eliseev, A. V. Yakovlev, A. S. Deryabin. - Tambov: Tambov State Technical University, EBS ASV, 2022. - 80 p. - ISBN 978-5-8265-2437-4. - Text: electronic // Digital educational resource IPR SMART: [site]. - URL: <https://www.iprbookshop.ru/123033> , unlimited copies
5. Popov, A. A. Operating systems: laboratory practical training / A. A. Popov, P. S. Shatalov, M. A. Masyuk. - Krasnoyarsk: Siberian State University of Science and

Technology named after Academician M.F. Reshetnev, 2020. - 80 p. - Text: electronic // Digital educational resource IPR SMART: [site]. - URL: <https://www.iprbookshop.ru/107209.html>, unlimited copies

8.1.2. List of additional literature:

6. Akinin, M. V. System programming in Linux. Part 1. Process management: a tutorial / M. V. Akinin, N. V. Akinina, S. V. Zasorin. - Moscow: KURS, 2024. - 192 p.
7. Akinin, M. V. System programming in Linux. Part 2. File systems: a tutorial / M. V. Akinin, N. V. Akinina, S. V. Zasorin. - Moscow: KURS, 2024. - 124 p.
8. Voitov, N. M. Basics of working with Linux: a training course / N. M. Voitov. - Moscow: DMK Press, 2019. - 216 p.
9. Goncharuk, S. V. Linux OS Administration: a tutorial / S. V. Goncharuk. - 4th ed. - Moscow: Internet University of Information Technologies (INTUIT), IP R Media, 2024. - 163 p.
10. Gunko, A. V. System programming in the Linux environment: a tutorial / A. V. Gunko. - Novosibirsk: Novosibirsk State Technical University, 2020. - 235 p.
11. Krishchenko, V. A. Fundamentals of programming in the kernel of the GNU/Linux operating system: a tutorial / V. A. Krishchenko, N. Yu. Ryazanova. - Moscow: Bauman Moscow State Technical University, 2010. - 36 p.
12. Mamaylenko, S. N. Operating systems. Part 1. Linux operating system: practical course / S. N. Mamaylenko. - Novosibirsk: Siberian State University of Telecommunications and Informatics, 2008. - 119 p.
13. Morenkova, O. I. Operating Systems. Learning Linux: A Tutorial / O. I. Morenkova, A. Yu. - Novosibirsk: Siberian State University of Telecommunications and Informatics, 2022. - 107 p.
14. Fedotova, D. E. OS Windows & OS Linux: laboratory work on the course "Operating Systems" / D. E. Fedotova. - Moscow: Russian New University, 2009. - 224 p.
15. Shirokov, A. I. Basics of working with the Astra Linux operating system: guidelines / A. I. Shirokov. - Moscow: Publishing House MISiS, 2022. - 68 p.
16. Shmakov, V. E. Open Systems and Linux Technologies: A Tutorial / V. E. Shmakov, M. V. Khludova. - St. Petersburg: Peter the Great St. Petersburg Polytechnic University, 2018. - 58 p.

8.2. List of educational and methodological support for independent work of students in a discipline (module)

17. Operating systems: a tutorial. – Stavropol: SKFU, 2013. – 213 p. – Text: electronic // Digital educational resource EBS SKFU [website]. – URL: <http://libdata.ncstu.ru/cgi-bin/ftreview.pl?r0001050CD61E>, unlimited copies
18. Guidelines for laboratory work on the subject "Operating systems". - Stavropol: SKFU, 2013. - 250 p. - Text: electronic // Digital educational resource EBS SKFU [website]. - URL: <http://libdata.ncstu.ru/cgi-bin/ftreview.pl?r0001050CA432>, unlimited copies

8.3. List of resources of the information and telecommunications network "Internet" required for mastering the discipline (module)

1. www.biblioclub.ru - Electronic library system "University Library Online"
2. www.eLibrary.ru - Scientific Electronic Library
3. www.iprbookshop.ru - IPRbooks Electronic Library System
4. www.catalog.ncfu.ru - Electronic library system of NCFU

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

Lectures are delivered using computers and multimedia presentations. During seminars and practical classes, students present presentations they prepared during their independent work hours.

Information reference systems:

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

1.	https://astralinux.ru/ – resource of the AstraLinux operating system
----	---

Software:

1	Astra Linux operating system
2	Presentations for lectures
3	Test task system
4	Distance learning system el.ncfu.ru

10. Description of the material and technical base necessary for the implementation of the educational process in the discipline (module)

The material and technical base ensures the implementation of all types of disciplinary and interdisciplinary training, laboratory, and research work of students (portable laptop, portable projector, computers with the necessary software and Internet access).

Lecture classes	1	The lecture hall is equipped with specialized furniture and technical teaching aids for presenting educational information to a large audience, including a laptop and a projector. Visual aids include topical presentations corresponding to the course syllabi.
Practical work	1	Computer class .
Independent work	1	A room for independent student work, equipped with computers and internet access, providing access to an 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 a discipline (module) by students with disabilities can be organized jointly with other students, as well as in separate groups.

The acquisition of a discipline (module) by 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, the following is provided when mastering a discipline (module):

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 the assignment, 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 the assignment, 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 curriculum for the discipline shall indicate: methods of interaction between participants in educational relations via the Internet (videoconferencing, electronic testing); links to the SKFU electronic information and educational environment, to educational platforms and resources of other organizations that are openly accessible via the Internet; for synchronous learning - the time of online classes and teachers; for asynchronous learning - the authors of online courses.

When organizing midterm assessments using distance learning technologies and e-learning, the Methodological Recommendations for the Application 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 the Russian Federation dated December 7, 2020, No. MN-19/1573-AN "On the Submission of Methodological Recommendations").

The implementation of the discipline with the use of 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 that provide 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.