

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
Grobova T.A.

WORKING PROGRAM OF THE DISCIPLINE

Signal and System / Сигналы и системы

Speciality	02.04.01 Mathematics and Computer Science
Specialization	Training Program for Electronic Information
Year of commencement of studies	2026
Form of study	full-time
It is implemented in semesters	3

Developed by

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1. The purpose and objectives of mastering the discipline

The purpose of mastering the discipline "Signal and System / Сигналы и системы" is to develop in the future specialist in the specialty 02.04.01 Mathematics and Computer Science specialization "Training Program for Electronic Information" comprehensive knowledge about the principles of construction, operation and protection of modern networks and information transmission systems, as well as the development of practical skills in their analysis and administration.

Objectives of the course:

- study of the architecture, topology and operating principles of modern computer networks and data transmission systems;
- mastering basic network technologies and information transfer protocols;
- development of skills in designing and configuring secure network infrastructures;
- study of methods and means of ensuring information security in data transmission networks;
- acquisition of practical skills in identifying and eliminating vulnerabilities in network systems;
- mastering modern approaches to monitoring and analyzing network traffic;
- development of competencies in the field of countering network attacks and protecting information during transmission.

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

The course "Signal and System / Сигналы и системы" is part of the compulsory curriculum developed by participants in educational relationships. It is taught in the third semester.

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, characterizing the stages of formation of competencies, indicators
PC-8 Capable of participating in the management of projects for the creation of information systems and software systems at various stages of the life cycle	ID-1 _{PC-8} Manages the development, development and maintenance of information systems and software systems ID-2 _{PC-8} Knows and applies software development trends in his/her professional activities	Selects and can explain : - the content of the stages of building computer networks; - reference models of interaction open systems; - principles construction and operation of information transmission systems and networks; typical structures and principles of organizing computer networks; basic telecommunication protocols; prospects for the development of computer networks

Code, formulation of competence	Code, indicator formulation	Planned learning outcomes for the discipline, characterizing the stages of formation of competencies, indicators
PC-9 Able to take into account knowledge of the problems and trends in the development of the software market in professional activities	ID-1 _{PC-9} Selects software for their professional activities, taking into account market development trends. ID-2 _{PC-9} Takes into account the development trends of the software market and applies these development trends in professional activities	Selects and uses network tools for data exchange, including the use of global information Internet networks ; develops network projects using basic technologies; - evaluates the performance of network projects; explores the characteristics network activity created projects. chooses the best way to solve problems professional activities taking into account the current state and trends development networks and systems transmission of information.

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

Amount of classes: total: 4 credits, 144 academic hours.	OFO, in academic hours
Contact work:	
Lectures	2
Laboratory work	
Practical classes	2
Independent work	140
Forms of control	
Exam	-
Credit 3 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				Indepe ndent work, hours	Forms of ongoing monitoring of academic performance
			Contact work of students with a teacher/of which in the form of practical training, hours					
			Lectu res	Prac tical clas ses	Laborato ry work			
3rd SEMESTER								
1.	Characteristics of sound signals Study of parameters of sound signals: frequency, amplitude, waveform. In this topic, students will explore sound signal parameters such as frequency, amplitude, phase, and waveform. Particular attention will be paid to the influence of these parameters on sound perception. By the end of this topic, students will understand the physical properties of acoustic signals.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview	
2.	Conversion of sound message into electrical signal Practice of digitization and amplification of sound information. In this topic, students will master the process of converting audio messages into electrical signals. Particular attention will be paid to microphones, amplifiers, and digitalization circuits. By the end of this topic, students will be able to describe the stages of audio digitalization.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview	

3.	Signal transmission via a digital communication channel Simulation of data transmission in digital form via various channels. In this topic, students will model the process of signal transmission over a digital communication channel. Particular attention will be paid to modulation, coding, and noise immunity methods. By the end of this topic, students will understand the fundamentals of digital data transmission.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9	2.0				8.0	Interview
4.	Wired environment Study of physical parameters and transmission characteristics in cables. In this topic, students will explore the parameters of wired data transmission media. Particular attention will be paid to the electrical characteristics of twisted pair, coaxial cable, and fiber optic cable. By the end of this topic, students will understand the specifics of selecting a medium for various applications.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9					8.0	Interview
5.	Modems for digital communication channels Analysis of the operation of modems, their types and modulation methods. In this topic, students will explore the operating principles of modems for digital communication channels. Particular attention will be paid to modulation and demodulation methods, as well as modem classification. By the end of this topic, students will understand how signals are converted between analog and digital forms.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9					8.0	Interview
6.	Wireless Environment The study of data transmission over radio channels and its limitations. In this topic, students will explore the characteristics of wireless data transmission environments. Particular attention will be paid to frequency ranges, coverage areas, and factors affecting signal quality. By the end of this topic, students will understand the limitations and advantages of radio communications.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9					8.0	Interview

7.	Radio relay lines Consideration of data transmission systems via radio relay channels. In this topic, students will explore the principles of constructing radio relay communication lines. Particular attention will be paid to line-of-sight conditions, repeaters, and frequency characteristics. By the end of this topic, students will understand the specifics of using radio relay communications over long distances.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
8.	Satellite communications Principles of organizing communications via satellites and repeaters. In this topic, students will explore the fundamentals of satellite communications. Particular attention will be paid to the architecture of satellite systems, orbit types, and signal relay principles. By the end of this topic, students will understand how data is transmitted via satellites.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
9.	Geostationary satellite The study of the characteristics of satellites fixed relative to the Earth. In this topic, students will study the characteristics of geostationary satellites. Particular attention will be paid to their orbital position, advantages, and limitations. By the end of this topic, students will understand the applications for which these satellites are used.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
10.	PDH Technology Analysis of the structure and principles of PDH multiplexing. In this topic, students will explore PDH (plesiochronous digital hierarchy) technology. Particular attention will be paid to the multiplexing structure and channel synchronization. By the end of this topic, students will understand how data transmission occurs in PDH networks.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview

11.	Synchronous Digital Hierarchy (SDH) Study of SDH standards and features of synchronous data transmission. In this topic, students will explore the synchronous digital hierarchy (SDH). Particular attention will be paid to synchronization principles, rate hierarchy, and flow structuring. By the end of this topic, students will be able to distinguish SDH from PDH and describe the advantages of the latter.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
12.	ATM Technology The concept of asynchronous cell transfer and the application of ATM in networks. In this topic, students will explore ATM (Asynchronous Transfer Mode) technology. Particular attention will be paid to fixed cell lengths, multiplexing, and traffic prioritization. By the end of this topic, students will understand where and how ATM is used in modern networks.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
13.	Basic concepts of teletraffic theory . Evaluation of traffic parameters and performance of communication channels. In this topic, students will explore the basic concepts of teletraffic theory. Particular attention will be paid to load modeling, probabilistic characteristics, and capacity estimation. By the end of this topic, students will be able to evaluate the efficiency of communication channels.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9		2.0		8.0	Interview
14.	Telegraph History and principles of transmitting text information. In this topic, students will explore the principles of telegraph communication. Particular attention will be paid to methods of transmitting text information, Morse code, and technical means. By the end of this topic, students will understand the historical significance and fundamentals of telegraphy.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				10.0	Interview

15.	Facsimile communication Principles of image transmission via communication channels. In this topic, students will explore the principles of facsimile communication. Particular attention will be paid to transmitting images over telephone lines, scanning, and image restoration. By the end of this topic, students will understand how faxing works.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
16.	Fax Standards Review of international standards for facsimile transmission. In this topic, students will study international fax standards. Particular attention will be paid to standard groups (G3, G4) and equipment requirements. By the end of this topic, students will be familiar with device compatibility rules.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				10.0	Interview
17.	Fax server Setting up and using servers for receiving/transmitting faxes. In this topic, students will explore the operation of a fax server. Particular attention will be paid to software and setting up fax transmission and reception over a computer network. By the end of this topic, students will be able to describe the architecture and functionality of a fax server.	ID-1 PC-8 ID-2 PC-8 ID-1 PC-9 ID-2 PC-9				8.0	Interview
	TOTAL for 3rd semester		2.0	2.0		140.0	
	TOTAL		2.0	2.0		140.0	

6. Fund of assessment tools for the discipline

The assessment toolkit (AST) for a course is based on a list of mastered competencies with associated indicators. 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 that define the procedures for assessing knowledge, skills, abilities and (or) work experience that characterize the stages of competencies formation (included in the methodological guidelines for those types of work that are provided for by the curriculum and provide for the assessment of the development of competencies);
- standard assessment tools necessary for assessing knowledge, skills and the level of development of competencies.

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 discipline "Signal and System / Сигналы и системы" is structured on a thematic principle, each topic is a logically complete section.

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

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. Reshetnikova I.V. NETWORKS AND SYSTEMS OF INFORMATION TRANSMISSION. Study guide. – Rostov-on-Don: SKF MTUCI, 2022. – 52 p.
2. Sinitsyn, Yu. I. Networks and information transmission systems: a tutorial / Yu. I. Sinitsyn, E. I. Ryapolova. - Orenburg: OSU, 2017. - 189 p. - ISBN 978-5-7410-1886-6.
3. Networks and information transmission systems: telecommunication networks: textbook and practical training for the academic bachelor's degree / edited by K. E. Samoylova, I. A. Shalimov, D. S. Kulyabov. - Moscow: Yurait Publishing House, 2017. - 363 p.

8.1.2. List of additional literature:

1. Networks and information transmission systems: a textbook / G.M. Chernoknizhny. - St. Petersburg: Publishing house of St. Petersburg State University of Economics, 2019. - 104 p.
2. Networks and information transmission systems: a tutorial (lecture course) / A. P. Zhuk, G. I. Linets, D. V. Orel, E. P. Zhuk. - Stavropol: North Caucasus Federal University, 2021. - 157 p.

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

1. Guidelines for organizing independent student work in the discipline "Networks and Information Transmission Systems." Stavropol: SKFU, 2026.

2. Guidelines for practical classes in the discipline "Networks and Information Transmission Systems." Stavropol: SKFU, 2026.

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

www.biblioclub.ru - Electronic library system "University Library Online"

www.eLibrary.ru - Scientific Electronic Library

www.iprbookshop.ru - IPRbooks Electronic Library System

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 utilize computer technology and multimedia presentations. During practical classes, students present reports on work they complete independently or in teams using computer technology and internet technologies.

Information reference systems:

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

1	https://www.garant.ru/
2	http://www.consultant.ru/

Software:

1.	Alt Workstation 10
2.	Alt Workstation K
3.	Alt "Server"
4.	Office suite - P7-Office

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

Lectures classes	A classroom for conducting classes, equipped with multimedia equipment and technical teaching aids.
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.