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MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
NORTH CAUCASIAN FEDERAL UNIVERSITY

I APPROVED BY
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WORKING PROGRAM OF THE DISCIPLINE

" Signal And system /Signal and System»

Direction of training	11.03.02 Infocommunication technologies and communication systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of commencement of studies	2026
Form of study	full-time
Implemented in a semester	4

Developed by
Professor of the Department of Digital,
robotic systems and electronics
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Doctor of Technical Sciences, professor
V.P. Mochalov

Stavropol, 2026

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

The purpose of mastering the discipline : to develop students' general professional competencies in the direction of scientific thinking and research activities.

Objectives of mastering the discipline :

1) Systematization of fundamental knowledge in the field of physics and mathematics, their use to solve practical problems in the formalization and analysis of the physical essence of processes associated with the receipt, transmission, processing and storage of information in information and telecommunication systems.

2) Practical training in conducting experimental research by modeling physical phenomena and processes arising in information and telecommunications systems, as well as in using basic techniques for processing and presenting the obtained data.

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

The discipline "Signal and System" refers to the disciplines of the compulsory part B1.O.22 of Block 1 of the Discipline

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
OPK-1. Capable of using the principles, laws, and methods of natural science and mathematics to solve engineering problems.	ID-1 $_{OPK-1}$ understands the fundamental laws of nature and the basic physical mathematical laws and methods of accumulation, transmission and processing of information.	Understands the fundamental laws of nature, physical phenomena, and processes that occur in telecommunications systems; the basic physical methods and mathematical techniques used in telecommunications for storing, transmitting, and processing information.
	ID-2 $_{OPK-1}$ applies physical laws and mathematical methods to solve theoretical and applied problems.	Applies physical laws and methods to formalize the representation of physical phenomena and processes occurring in telecommunications.
	ID-3 $_{OPK-1}$ uses knowledge of physics and mathematics when solving practical problems.	Uses knowledge of physics to solve practical engineering problems in the field of telecommunications.
OPK-2. Capable of independently conducting experimental research and using basic techniques for processing and presenting the obtained data.	ID-3 $_{OPK-2}$ understands the basic methods and means of conducting experimental research, standardization and certification systems.	Understands the basic methods and means of conducting experimental research using computer technology.
	ID-4 $_{OPK-2}$ selects measurement methods and tools and conducts experimental research.	Selects the necessary methods and means of measurement, conducts experimental research.
	ID-5 $_{OPK-2}$ has methods for processing and presenting the obtained data and assessing the error of the measurement results.	Proficient in methods of processing and presenting obtained laboratory data and assessing the error of measurement results.

Code, formulation of competence	Code, indicator formulation	Planned learning outcomes for the discipline (module), characterizing the stages of formation of competencies, indicators
OPK-3. Capable of applying methods for searching, storing, processing, analyzing, and presenting information from various sources and databases in the required format, while adhering to basic information security requirements.	ID-1 $_{OPK-3}$ understands the basic principles of information transmission in information and communication systems, the main types of signals used in telecommunication systems, and the specifics of transmitting various signals through channels and paths of telecommunication systems.	understands the basic principles of information transmission in information and communication systems, the main types of signals used in telecommunication systems, and the specifics of transmitting various signals through channels and paths of telecommunication systems.
	ID-2 $_{OPK-3}$ understands the principles, basic algorithms, and devices of digital signal processing; the principles of constructing various types of telecommunication systems and methods of distributing information in communication networks.	understands the principles, basic algorithms and devices of digital signal processing; the principles of constructing telecommunication systems of various types and methods of distributing information in communication networks.
	ID-3 $_{OPK-3}$ solves data processing problems using computer technology.	solves data processing problems using computer technology.
	ID-4 $_{OPK-3}$ builds probabilistic models for specific processes and carries out the necessary calculations within the framework of the constructed model.	builds probabilistic models for specific processes and carries out the necessary calculations within the framework of the constructed model.
	ID-5 $_{OPK-3}$ has the methods and skills to ensure information security.	possesses methods and skills to ensure information security.

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

Amount of classes: total: 5 credits, 180 academic hours.	OFO, In academic hours
Contact work:	48.00/0
Lectures/including practical training	0
Laboratory work /including practical training	0
Practical classes /including practical training	48.00/0

Independent work	78.00
Forms of control	
Exam	54.00
Credit	-
Credit with grade	-
Coursework	No

5. The content of the discipline (module), 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	full-time education				Forms of the current control academic performance
			Contact work of students with a teacher/of which in the form of practical training, hours			Independent work, hours	
			Lectures	Practical classes	Laboratory work		
4th semester							
1	Information and telecommunication infrastructure as a complex physical system. Basic concepts and definitions. General principles of organizing hardware for telecommunications networks and systems. Global information infrastructure (GII). Discrete elements and their implementation. Manufacturing and installation of hardware for telecommunications systems. Practical Lesson #1. Processes for establishing various types of connections using 2vsk signaling (r1.5)	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK-2 ID-4 OPK-2 ID-5 OPK-2 OPK-3 ID-1 OPK-3 ID-2 OPK-3 ID-3 OPK-3 ID-4 OPK-3 ID-5 OPK-3		12:00 / 12:00		6:00 PM	Interview
2	Hardware for processing digital signals in telecommunication systems. DAC hardware and interfaces. ADC and DAC characteristics. Coding and modulation, multiplexing and demultiplexing. Practical Lesson #2. Signal Unit Format OX #7	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK- 2 ID-4 OPK-2 ID-5 OPK-2 OPK-3 ID-1 OPK-3 ID-2 OPK-3 ID-3 OPK-3 ID-4 OPK-3		12:00 /12:00		8:00 PM	Interview

		ID-5 OPK-3					
3	Hardware of subscriber devices. Hardware for subscriber telephony devices. Hardware for subscriber devices for IP telephony. Hardware for mobile subscriber devices. Practical Lesson #3. ISUP Subsystem Signaling Message Format	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK- 2 ID-4 OPK-2 ID-5 OPK-2 OPK-3 ID-1 OPK-3 ID-2 OPK-3 ID-3 OPK-3 ID-4 OPK-3 ID-5 OPK-3		12:00 / 12:00		8:00 PM	Interview
4	Management and calculation of configuration parameters of hardware of telecommunication systems. hardware configuration management telecommunication systems. Calculation and limitations of the parameters of telecommunication hardware nications. Calculation of hardware parameters of the packet processing system Practical Lesson #4. Connection Establishment Processes Using the isup-r Subsystem	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK - 2 ID-4 OPK-2 ID-5 OPK-2 OPK-3 ID-1 OPK-3 ID-2 OPK-3 ID-3 OPK-3 ID-4 OPK-3 ID-5 OPK-3		12.00 /12.00		20.00	Interview
	EXAM					54.00	
	THAT'S IT for the semester			48.00 /48.00		132.00	

6. **Fund of assessment tools for the discipline (module) "Physical foundations of telecommunications"**

The assessment toolkit (AST) for ongoing monitoring of student progress and midterm assessment in a course (module) is based on a list of competencies being mastered, indicating the stages of their development during the course (module) mastery. 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 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 classes are held 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 laboratory work, and completion of all types of independent work.

To successfully master the course, 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 (module)

8.1.1. List of main literature:

Sagdeev K.M., Goncharov D.G. Physical Foundations of Telecommunications: Textbook / K.M. Sagdeev, D.G. Goncharov. - Stavropol: North Caucasus Federal University, 2022. - 442 p. - The book is in the basic version of the IPRbooks electronic library system.

Goldstein A.E. Physical Foundations of Obtaining Information Electronic resource: Textbook / A.E. Goldstein. - Tomsk: Tomsk Polytechnic University, 2010. - 292 p. - The book is in the premium version of the IPR BOOKS electronic library system. - ISBN 978-5-98298-650-4.

Evstifeev V.V. Physical foundations of electricity and magnetism Electronic resource / Evstifeev V.V.: textbook. - Penza: PSU, 2019. - 416 p.

8.1.2. List of additional literature:

Deart V. Yu. Multiservice communication networks. Transport networks and access networks [Electronic resource]: a tutorial / V. Yu. Deart. - Electronic text data. - M.: Moscow Technical University of Communications and Informatics, 2014. - 101 p. - 948-5-905376-13-9. - Access mode:

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

8.2.1 Lecture notes on the subject "Signal and System" / compiled by V.P. Mochalov

2. Practical classes in the discipline "Signal and System" / compiled by V.P. Mochalov.

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

8.3.1. http://book.itep.ru/.

8.3.2. http://sokolov.niits.ru/lectures.htm

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

When giving lectures, computer technology is used to demonstrate presentation multimedia materials.

During practical classes, students conduct research on analog and digital circuit devices using computer modeling software and industrial laboratory setups.

Information reference systems:

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

1. http://book.itep.ru/.

2. http://sokolov.niits.ru/lectures.htm

Software:

1. Cisco Packet Tracer
2. PTC Mathcad Prime. Perpetual license. Agreement No. 29-ea/14 dated July 8, 2014.

3 Alt Workstation 10
4 Alt Workstation K
5 Alt "Server"
6 Office suite - P7-Office

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	A classroom for conducting classes, equipped with multimedia equipment and technical teaching aids.
Practical classes	A classroom for conducting classes, equipped with multimedia equipment, technical teaching aids and special network equipment.
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 (module) 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 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 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 educational technologies are educational technologies implemented primarily using information and telecommunications networks with indirect (at a distance) 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 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.