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Информация о владельце:

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

APPROVED BY

Acting Director of the Institute

Advanced Engineering

Cand. Tech. Sci., Associate Professor

A.A. Porokhnya

WORK PROGRAM OF THE DISCIPLINE

"Random signal analysis"

Field of study	11.03.02 Infocommunication Technologies and Communication Systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of start of training	2026
Form of study	Full-time
Implemented in a semester	7

Developed by

Associate Professor at the School of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering

Cand. Tech. Sci., Associate Professor

Samus M.V.

Stavropol 2026

1. Purpose and objectives of mastering the discipline (module)

The purpose of mastering the discipline is to master mathematical methods for students to analyze the performance indicators of switching facilities and inter-node branches of communication networks necessary for them to acquire the appropriate competencies (PC-2) in scientific and production activities, to develop the ability to model real processes and systems.

Objectives of mastering the discipline:

- to teach how to collect, process and interpret the data of modern scientific research necessary for the formation of conclusions on the relevant scientific research;
- to teach how to analyze the processes taking place in communication networks and predict their impact on the performance indicators of these networks;
- to instill the ability to find rational solutions to problems arising during the operation and study of the characteristics of communication networks, to systematize and analyze data on the efficiency of the operation of communication networks and to develop proposals for their improvement.

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

The discipline belongs to block B1.B.06. "Disciplines (modules)" (Part formed by the participants of educational relations). Its development takes place in the 7th semester.

3. List of planned learning outcomes in the discipline (module) correlated with the planned results of the development of the educational program

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
PC-2. Able to apply modern theoretical and experimental research methods in order to create new promising means of infocommunications, use and implementation of research results	ID-1PK-2 understands and is guided by the principles of construction and operation of communication networks, including their constituent subsystems, and signaling protocols, standards for the quality of data, voice and video transmission used in communication networks, in the legislation of the Russian Federation in the field of communications.	Is able to use the principles of construction and operation of communication networks, including their constituent subsystems, and signaling protocols, standards for the quality of data, voice and video transmission used in communication networks, the legislation of the Russian Federation in the field of communications when solving practical problems.
	ID-2PC-2 analyzes the statistical parameters of traffic, develops solutions for the prompt reconfiguration of the network, changing the parameters of the switching subsystem, network platforms, for the use of equipment of new technologies; changing and adjusting the parameters of the switching subsystem, transport networks and data transmission networks, for organizing new and expanding existing communication directions.	Able to analyze statistical parameters of traffic, develop solutions for operational reconfiguration of the network, change of parameters of the switching subsystem, network platforms, on the use of equipment of new technologies; change and adjust the parameters of the switching subsystem, transport networks and data transmission networks, on the organization of new and expansion of existing communication directions.

Code, formulation of competence	Indicator code, wording	Planned learning outcomes in the discipline (module), characterizing the stages of the formation of competencies, indicators
	ID-3PK-2. analyzes the statistics of the main indicators of the efficiency of radio systems and data transmission systems, develops measures to maintain them at the required level, calculates the capacity of telecommunication networks.	It is able to analyze the statistics of the main performance indicators of radio systems and data transmission systems, develop measures to maintain them at the required level, and calculate the capacity of telecommunications networks.

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

Scope of classes: total: 8 EC 288 academic hours	OFO, In acad. hours
Contact work:	24.00/0
Lectures/from them practical training	No
Laboratory work/from them practical training	No
Practical training/of which practical training	24.00
Independent work	264.00
Forms of control	
Exam	No
Credit with a grade	No
Credit	Yes
Course work	No

* The discipline (module) provides for the use of e-learning, distance learning technologies (*unless otherwise established by the educational standard*)

5. The content of the discipline (module), structured by topics (sections) with an indication of the number of hours and types of classes

			Full-time	Current Forms
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№	Section (topic) of the discipline and summary	Emerging competencies, indicators	Contact work of students with the teacher / of them in the form of practical training, hours			Independent work, hours	control Academic Performance
			Lectures	Practical exercises	Laboratory work		
1	Mathematical foundations of the theory of teletraffic Event flows in multiservice networks. Palm flows. Erlang flows. Duration of order service in elements of multiservice networks and the flow of their releases. Main characteristics of nodes and branches of multiservice networks. The concept of the Markov stochastic process. Kolmogorov equations for probabilities of Markov system states. Final probabilities of Markov system states with continuous time and discrete states. The process of "death and multiplication". Little's formula. Practical lesson No1 Investigation of Kolmogorov equations for probabilities of states of Markov systems with continuous time and discrete states	PC-2 ID-1PK-2 ID-2PK-2 ID-3PK-2 6		6/6		66	Practical Work Defense
2	Multi-service systems with denial of service. Single-channel multi-service system with failures. Multi-channel multi-service system with failures. Practical lesson No2 Investigation of indicators of the efficiency of communication networks in the transmission of messages with service failures	PC-2 ID-1PK-2 ID-2PK-2 ID-3PK-2		6/6		66	Practical Work Defense

3	Multi-service systems with queues. A single-channel multi-service system with an unlimited queue of requests waiting to be serviced. A single-channel multi-service system with a limited queue of requests, waiting for service. Multi-channel multi-service system with standby and limited queue accumulator. Multi-channel multi-service system with standby and unlimited queue accumulator. Multi-channel multi-service system with limited waiting time and unlimited queue accumulator. Multi-channel multi-service system with limited waiting time and limited queue accumulator. Practical lesson No3 Investigation of the probability of finding switching equipment in the zero state during the transmission of information with service failures	PC-2 ID-1PK-2 ID-2PK-2 ID-3PK-2		6/6		66	Practical Work Defense
4	Multi-service systems with priorities Principles of service in multi-service networks of multi-priority traffic. Average wait time in priority systems. Average wait time in systems with relative fixed priorities. Average service time in systems with absolute fixed priorities. Practical lesson No4 Investigation of the probability of finding switching equipment in the zero state during information transmission in queued systems	PC-2 ID-1PK-2 ID-2PK-2 ID-3PK-2		6/6		66	Practical Work Defense
	TOTAL			24/24		264	

6. Fund of assessment tools for the discipline (module)

The Assessment Tools Fund (OSF) for the discipline (module) The analysis of random signals is based on the list of competencies to be mastered with the indication of indicators. The CSF provides objective control over the achievement of the planned learning outcomes.

- description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales;
- methodological materials that determine the procedures for assessing knowledge, skills, and (or)

work experience that characterize the stages of competence 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 formation of competencies);

- standard assessment tools necessary for assessing knowledge, skills and the level of competence formation.

The FAT is an appendix to this program of the discipline (module).

7. Methodical instructions for students on the development of the discipline

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

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

The lecture material is devoted to the consideration of the key, basic provisions of the courses and the explanation of educational tasks submitted for independent work of students.

Practical work is carried out in order to consolidate the learned information, to acquire the skills of its application in solving practical problems in the relevant subject area.

Independent work of students is aimed at independent study of additional material, preparation for laboratory classes, as well as the performance of all types of independent work.

For the successful development of the discipline, it is necessary to perform all types of independent work, using the recommended sources of information.

8. Educational, methodological and information support of the discipline

8.1. List of basic and additional literature necessary for mastering the discipline (module)

8.1.1. List of basic literature:

1. Iversen V.B. Development of Teletraffic and Planning of Networks [Elektronnyi resurs]: uchebnoe posobie [Development of Teletraffic and Planning of Networks]. - Development of Teletraffic and Planning of Networks. - Moscow: Internet University of Information Technologies (INTUIT), 2016. - 625 p. - The book is in the basic version of the EBS IPRbooks., there are unlimited copies.
2. Reshetnikova I.V. Theory of Teletraffic Elektronnyi resurs [Theory of Teletraffic Elektronnyi resurs] / Reshetnikova I.V.: textbook. - Rostov-on-Don: RGUPS, 2019. - 80 p. - ISBN 978-5-88814-923-2, unlimited copies.

8.1.2. List of additional literature:

1. Fundamentals of Infocommunication Technologies: Theory of Teletraffic: Textbook / E.D. Bychkov, V.A. Maistrenko, O.N. Kovalenko, D.N. Kovalenko; ed. by V.A. Maistrenko; Ministry of Education and Science of Russia, Omsk State Technical University. - Omsk: OmSTU Publishing House, 2017. - 156 p.: graphs, schemes. - References: p. 130-131 - ISBN 978-5-8149-2433-9; Same [Electronic resource]. - URL: <http://biblioclub.ru/index.php?page=book&id=493271>, unlimited copies.

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

1. Guidelines for the performance of laboratory work on the discipline "Teletraffic of multiservice networks". – Stavropol, NCFU, 2026.

2. Guidelines for students on the organization and conduct of independent work in the discipline "Teletraffic of multiservice networks". – Stavropol, NCFU, 2026.

8.3. List of resources of the information and telecommunication network "Internet" necessary 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 - Electronic library system IPRbooks.

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 equipment is used, demonstration of presentation multimedia materials.

Information reference systems:

Information and reference and information and legal systems used in the study of the discipline:
1. <http://catalog.ncfu.ru/catalog/ncfu> – Official site of the Scientific Library of the Federal State Autonomous Educational Institution of Higher Education of NCFU.

Software:

1. Operating system: Microsoft Windows 8: Perpetual license. Contract No 01-ea/13 dated 25.02.2013.
2. Operating system: Microsoft Windows 10: Perpetual license. Contract No 544-21 dated 06/08/2021.
3. Basic package of Microsoft Office programs (Word, Excel, PowerPoint). Microsoft Office Standard 2013: Contract No 01-EA/13 dated 25.02.2013, Microsoft Office <https://support.microsoft.com/ru-ru/lifecycle/search/16674> License.

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

Lectures	Classroom for training sessions, equipped with multimedia equipment and technical teaching aids.
Practical work	Classroom for training sessions, equipped with multimedia equipment and technical teaching aids.
Independent work	Room for independent work of students, equipped with computer equipment with the ability to connect to the Internet and the ability to access the electronic information and educational environment of the university

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 (assistant) who provides students with the necessary technical assistance, as well as the services of sign language interpreters and typhlo-sign interpreters.

The development of a discipline (module) by students with disabilities can be organized together with other students, as well as in separate groups.

The development 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 the accessibility of higher education under the educational program by persons with disabilities when mastering the discipline (module), the following is ensured:

- 1) for visually impaired persons:
 - the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take a workplace, move, read and complete the task, including by writing down by dictation),
 - written tasks, as well as instructions on the procedure for their implementation, are drawn up in enlarged font,
 - special textbooks, teaching aids and didactic materials (with large print or audio files),
 - individual uniform lighting of at least 300 lux,
 - if necessary, the student is provided with a magnifying device to complete the task;
- 2) for persons with hearing disabilities:
 - the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take a workplace, move, read and complete the task, including by writing down by dictation),
 - the availability of sound-amplifying equipment for collective use is ensured, if necessary, the student is provided with sound-amplifying equipment for individual use;
 - is provided with appropriate sound means of reproducing information;
- 3) for persons with disabilities with musculoskeletal disorders (including those with severe disorders of the motor functions of the upper extremities or the absence of upper limbs):
 - written tasks are performed on a computer with specialized software or dictated to an assistant;
 - At the request of the student, tasks can be performed orally.

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

According to Part 1 of Article 16 of the Federal Law of December 29, 2012 No 273-FZ "On Education in the Russian Federation", e-learning is understood as the organization of educational activities with the use of information contained in databases and used in the implementation of educational programs and information technologies, technical means, as well as information and telecommunication networks that ensure the transmission of this information through communication lines, the interaction of students and teachers. Distance educational technologies are understood as educational technologies implemented mainly with the use of information and telecommunication networks with indirect (at a distance) interaction of students and teachers.

The discipline can be implemented using distance learning technologies and e-learning in whole or in part. The components of the discipline's teaching materials (the discipline's work program, assessment and methodological materials, forms of certification), implemented using distance learning technologies and e-learning, contain an indication of their use.

When organizing educational activities with the use of distance educational technologies and e-learning, asynchronous and synchronous ways of interacting with participants in educational relations through the information and telecommunication network "Internet" may be provided.

When using distance learning technologies and e-learning, the schedule for the discipline indicates: ways of interaction between participants in educational relations through the information and telecommunication network "Internet" (videoconferencing, ET - electronic testing); links to the electronic information and educational environment of NCFU, to educational platforms and resources of other organizations to which open access is provided through the information and telecommunication network "Internet"; for synchronous learning - the time of online classes and teachers; for asynchronous learning - the authors of online courses.

When organizing interim certification using distance learning technologies and e-learning, the Methodological Recommendations for the Use of Technical Means That Ensure the Objectivity of Results in the Conduct of Interim and State Final Certification in Educational Programs of Higher Education - Bachelor's Degree Programs, Specialist Programs and Master's Degree Programs with the Use of Distance Educational Technologies (Letter of the Ministry of Education and Education of Russia dated 07.12.2020 No MN-19/1573-AN "On the Direction of Methodological Recommendations") are used.

The implementation of the discipline using e-learning and distance learning technologies is carried out using the electronic information and educational environment of NCFU, to which students have access through the information and telecommunication network "Internet", or using the resources of other organizations, including platforms that provide services for video conferences, online meetings and distance learning (MTS-Link), as well as using the capabilities of social networks for communication between students and teachers.

Educational and methodological support of the discipline implemented with the use of e-learning and distance educational technologies includes a work program, teaching aids or a course of lectures presented in electronic form, guidelines for the implementation of various types of educational activities of students provided for by the discipline, and other educational materials posted in the information and educational environment of NCFU.