

Документ подписан простой электронной подписью

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 CAUCASIAN FEDERAL UNIVERSITY

I APPROVED BY

Acting director of the institute
advanced engineering

Ph.D. tech. Sciences, Associate Professor
A.A. Porokhnya

WORKING PROGRAM OF THE DISCIPLINE

Computer Communications and Networking

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

Associate Professor of the Department of Digital,
robotic systems and electronics
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Gaichuk D.V.

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

The purpose of mastering the discipline : studying the methodology of constructing modern communication networks, basic technologies of telecommunication networks, as well as the design and management of multi-protocol computer networks.

Objectives of mastering the discipline :

- 1) study of the principles and stages of construction of modern communication networks;
- 2) study of methods of information exchange in communication networks;
- 3) study of the operating principles of network communications equipment.

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

The course "Computer Communications and Networks" is a compulsory course in Block 1 of the Discipline (modules). B1.O.25.

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-4. Able to understand the operating principles of modern information technologies and use them to solve professional problems.	ID-1 OPK-4 uses information and communication technologies to search for the necessary information.	Uses information and communication technologies when searching for necessary information.
	ID-3 OPK-4 understands modern interactive software packages and basic methods of processing experimental data, including the use of standard software, general-purpose and special-purpose software packages.	Understands modern interactive software systems and basic techniques for processing experimental data, including the use of standard software, general-purpose and special-purpose software packages.
	ID-4 OPK-4 uses the capabilities of computing technology and software to solve problems of control and algorithmization of information processing processes.	Uses the capabilities of computing technology and software to solve problems of management and algorithmization of information processing processes.

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

Amount of classes: total: <u>3</u> credits, 108 academic hours.	OFO, in academic hours
Contact work:	32.00

Lectures/including practical training	No
Laboratory work /including practical training	No
Practical classes /including practical training	32.00
Independent work	76.00
Forms of control	
Exam	No
Credit	Yes
Credit with grade	No
Coursework	No

* The course (module) involves the use of e-learning and distance learning technologies (*unless otherwise established by the educational standard*)

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

N o.	Section (topic) of the discipline and brief content	Developed competen- cies, indica- tors	full-time education				Forms of the current control academic per- formance
			Contact work of students with a teacher/of which in the form of practical training, hours			Independent work, hours	
			Lectures	Practical classes	Laboratory work		
1.	General information about network technologies. Fundamentals of network technologies. Classification of data transmission networks. Seven-layer model of open systems interconnection. The composition and functions of the model layers. Devices and information units of the corresponding layers. Data encapsulation. The OSI and TCP/IP models. Message transmission over the network. Practical work No. 1 Creating Straight and Crossover Unshielded Twisted Pair Cables	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		6		18	Interview

2.	Physical layer of the OSI model. Copper cables. Fiber optic cables. Wireless media. Practical work #2 Exploring the Cisco Packet Tracer Network Simulator	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		4		18	Interview
3.	Data link layer of the TCP/IP stack. LLC and MAC sublayers. Ethernet local area networks. Switches in local area networks. Collision domains. Two-way communication modes. Switch operating algorithm. Switching modes. Address Resolution Protocol (ARP). Data exchange in a local area network. General information about the ARP protocol. Problems with the ARP protocol. Practical work #3 Defining network adapter parameters and IP protocol settings	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		4		18	Interview
4.	Network layer protocols. Network layer tasks. IP protocol characteristics. IPv4 packet. IPv6 packet. IPv4 network addresses. Binary to decimal conversion. IPv4 address structure. IPv4 address types. IPv6 network addresses. Using IPv4 and IPv6 protocols together. Representation of IPv6 addresses. Types of IPv6 addresses. IP Network Subnetting. IPv4 Network Subnetting. Addressing Schemes. Router Functions. Routers in Networking. Routing Principles. Routing Tables. Practical work #4 Subnet planning	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		6		18	Interview
5.	Transport layer. Transport Layer Functions. Transport Layer Protocols. Transport Layer Ports. Transport Layer Data Exchange. TCP Data Exchange. Reliability and Flow Control. UDP Data Exchange. Practical work #5 Modeling networks using bus and star topological structures	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		6		18	Interview

6.	Upper levels of OSI , TCP/ IP models . Application-level tasks. Network- ing models. Email transfer proto- cols. HTTP protocol . File transfer protocols (FTP) and TFTP . Do- main Name System (DNS). Telnet . Dynamic Host Configuration Pro- tocol (DHCP). Practical work #6 Research of Switch 2960 commu- nications equipment	OPK-4 OPK-4 ID-1 OPK-4 ID-3 OPK-4 ID-4		6		18	Interview
	TOTAL			32		108	

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

The Assessment Toolkit (AT) for ongoing performance monitoring and midterm assessment of students in the course (module) " Computer Communications and Networking " 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.

Laboratory 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 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:

1. Skvortsova T.I. Computer communications and networks Electronic resource / Skvortsova T.I.: teaching aid. - Moscow: RTU MI-REA, 2020. - 223 p., unlimited copies.
2. Berlin A.N. High-speed communication networks Electronic resource: textbook / A.N. Berlin. - High-speed communication networks. - Moscow: Internet University of Information Technologies (INTUIT), 2016. - 437 p. - The book is in the basic version of the IPRbooks electronic library system, unlimited copies.

3. Proskuryakov A.V. Computer networks: fundamentals of building computer networks and telecommunications: study guide / A.V. Proskuryakov; Ministry of Science and Higher Education of the Russian Federation; Federal State Autonomous Educational Institution of Higher Education "Southern Federal University"; Engineering and Technology Academy. - Rostov-on-Don|Taganrog: Publishing house of Southern Federal University, 2018. - 202 p.: ill. - <http://biblioclub.ru/>. - Bibliography: pp. 195-196. - ISBN 978-5-9275-2792-2, unlimited copies.

8.1.2. List of additional literature:

1. Shishova N.A. Fundamentals of Construction of Infocommunication Systems and Networks [Electronic resource]: study guide / N. A. Shishova. - Electronic text data. - M.: Moscow Technical University of Communications and Informatics, 2015. -- 43 p. - 2227-8397. - Access mode: <http://www.iprbookshop.ru/61512.html>, unlimited copies.

2. Olifer V.G. Computer networks: principles, technologies, protocols: textbook for universities / V.G. Olifer, N.A. Olifer. - 4th ed. - St. Petersburg [and others]: Piter, 2014. - 944 p. : ill. - (Textbook for universities). - APPROVED BY: Rec. MO. - Bibliography: p. 917. - Alphabetical index: pp. 918-943. - ISBN 978-5-469-00004-8 – 14 copies.

3. Oliver Ibe Computer Networks and Remote Access Services Electronic resource: Textbook / Ibe Oliver; trans. I. V. Sinitsyn. - Computer Networks and Remote Access Services. - Saratov: Profobrazovanie, 2017. - 333 p. - The book is in the premium version of the IPR BOOKS electronic library system. - ISBN 978-5-4488-0054-2, unlimited copies.

4. Ziangirowa L.F. Network Technologies Electronic resource: Textbook / L.F. Ziangirowa. - Saratov: University education, 2017. - 100 p. - The book is in the premium version of the IPR BOOKS electronic library system. - ISBN 978-5-906172-30-3, unlimited copies.

5. Guidelines for Completing Laboratory Work in the Course "Computer Networks": Field of Study 44.03.05 Pedagogical Education. Profile of Study: Computer Science and Foreign Language (English). Graduate Qualification: Bachelor's Degree. Mode of Study: Full-time. 2018 Curriculum. Studied in the 7th and 8th semesters. / North-Caucasian Federal University. - Stavropol: SKFU, 2017. - 206 p., unlimited copies.

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

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

1. NetCracker Professional Users Guide and Reference Manual [electronic resource] // <http://www.netcracker.com/>.
2. Single-window access to educational resources: [portal]. URL: <http://window.edu.ru/>
3. National Open University INTUIT. URL: <http://www.intuit.ru/>

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 laboratory work, students conduct research into the operation of intermediate network 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.	NetCracker Professional Users Guide and Reference Manual [electronic resource] // http://www.netcracker.com/ .
2.	Single-window access to educational resources: [portal]. URL: http://window.edu.ru/
3.	National Open University INTUIT. URL: http://www.intuit.ru/

Software:

1.	Cisco Packet Tracer .
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2.	PTC Mathcad Prime.
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	1	The classroom is equipped with equipment and technical teaching aids for presenting educational information: a portable laptop, an interactive whiteboard Hitachi-Trio-77.1573*1180mm, US; an Acer PD525 projector.
Laboratory classes	1	A classroom equipped with the necessary equipment and technical training aids for presenting educational information: ? portable laptop, interactive whiteboard, BenQ RB 8263 projector; ? standard set of educational equipment "Wireless Computer Networks"; ? standard set of educational equipment "Wide Area Networks WAN-3" Uchtekh-Profi; ? standard set of educational equipment "Wireless Computer Networks"; ? servers #1 - 4 pcs., #2 - 1 pc., #3 - 1 pc., #4 - 1 pc. ? server redundancy kit - 1 pc., FG-TDMoIP - SR-4E1 interface converter - 2 pcs., console with server equipment switch - 1 pc. ? Zyxel IES-1000 ADSL2+ hub with modems - 1 pc.; ? Cisco 2811-CSME/2811 routers - 1 pc., Cisco 2811(2FE) - 1 pc., SHDSL ZyXEL Prestige 791 ReE - 4 pcs., Zyxel P-792H EE - 2 pcs.; ? modems FG-PAM-SRL-4 Eth-R.NG - 11 pcs., FG-PAM-4SAN- Eth-R.NG - 19 pcs., FG-PAM-S-4Eth.NG - 8 pcs., FG-PAM-SRL-4Eth.NG - 4 pcs., G SHDSL Zixel Prestige 782 m EE - 1 pc., Telindus 1421 - 2 pcs., ZyX 2602R-EE - 2 pcs., FG-PAM-SAN-4E-NG - 3 pcs.; ? Zyxel IES-1000 (SAM100b) modules - 1 pc., FlexDSL (FG-PAM-SAN-4Eth-R) - 3 pcs., WS-G5486 - 2 pcs., WS-X3500-XL - 2 pcs., Zyxel SAM -1008 - 2 pcs., Zixel SAM-10 8xG.shdsl modem interface module - 3 pcs.; ? interactive whiteboard, BenQ PB 8263 projector; ? 7 workstations consisting of: system unit P4-3.2/HDD 160/2048/keyboard/mouse/pad, HPE273q monitor. ? 4 workstations consisting of: system. Asus Intel(R) Celeron(R)/CPU G540/2048/keyboard/mouse unit, Samsung S19C200N monitor. Internet connection, access to the university's corporate network.
Independent work	1	A room equipped with computers with Internet access and access to the electronic information and educational environment of SKFU.

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 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 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.