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

APPROVED BY
Acting Director of the Institute
Advanced Engineering
A.A. Porokhnya

WORK PROGRAM OF THE DISCIPLINE
"Intelligent Control System"

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	6

Developed by
Associate Professor at the School
of Digital, Robotic Systems and
Electronics, PhD in Physics and
Mathematics,
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1. Purpose and objectives of mastering the discipline (module)

The purpose of the discipline is to study the basics and principles of intelligent control systems, the principles of building control systems using artificial intelligence technology, the basics of digital signal processing.

Objectives of mastering the discipline:

Study of the basic principles of control and system organization, mathematical foundations of models of intelligent control systems, AI methods, principles of building control systems, basics of developing intelligent control systems, as well as principles and methods of software implementation of control algorithms in intelligent systems.

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

The discipline refers to the part formed by the participants of educational relations of the block "Block 1. Disciplines (modules)". Its development takes place in the 6th 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-1 Capable of developing switching subsystems and network platforms, data transmission networks, transport networks and radio access networks, satellite communication systems	ID-1PK-1 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.	Knows 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.
	ID-2PK-1 analyzes statistical parameters of traffic, develops solutions for operational 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.	Studies the statistical parameters of traffic, develops solutions for the operational reconfiguration of the network, changing the parameters of the switching subsystem, network platforms, for the use of equipment for 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.
	ID-3PK-1. analyzes the statistics of the main performance indicators of radio systems and data transmission systems, develops measures to maintain them at the required level, calculates the capacity of telecommunications networks.	Understands and applies statistics on the main performance indicators of radio and data transmission systems, develops measures to maintain them at the required level, and calculates the capacity of telecommunications networks.

	ID-4PC-1 develops communication schemes and integration of new network elements, builds and expands the switching subsystem and network platforms; performs work on switching equipment, deploys service platform equipment, equipment of new technologies on the network, fulfills plans to expand existing equipment of network platforms and new technologies.	Develops schemes for the organization of communication and integration of new network elements, builds and expands the switching subsystem and network platforms; performs work on switching equipment, deploys equipment for service platforms, equipment for new technologies on the network, fulfills plans to expand existing equipment of network platforms and new technologies.
PC-2. Able to apply modern theoretical and experimental research methods in order to create new promising	ID-1PK-2 understands the basics of electrical engineering, network technologies, principles of operation, indicators of the use and functioning of telecommunication equipment, the requirements of technical regulations, international and national standards and other regulatory documents in the field of assessing the quality indicators of information and communication equipment.	Knows and understands the basics of higher mathematics, physics, the basics of computer technology and programming.
	ID-2PK-2 complies with the requirements of programs and methods for conducting experimental tests of communication facilities and systems (information and communication equipment).	Solves standard professional problems using natural science and general engineering knowledge, methods of mathematical analysis and modeling
	ID-3PC-2 works with software used in the processing of information of infocommunication systems and their components, technical means of data collection and processing, with various information systems and databases.	I am ready to conduct theoretical and experimental studies of objects of professional activity
	ID-4PK-2 controls the quality indicators of the operation of information and communication equipment in accordance with their standard indicators.	Understands the basic methodology for setting up and setting up software and hardware systems.
	ID-5PK-2 to conduct experimental studies on the existing programs and methods of testing objects and communication systems (information and communication equipment) in order to assess their quality performance.	Understands the basic principles and mathematical description of the processes of operation of software and hardware systems. Is ready to participate in the configuration and

		commissioning of software and hardware systems.
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4. Scope of the academic discipline (module) and forms of control*

Scope of classes: total: <u>4</u> EC, <u>144</u> academic hours.	OFO, in acad. hours
Contact work:	
Lectures/from them practical training	
Laboratory work/from them practical training	-
Practical training/of which practical training	24
Independent work	66
Forms of control	
Exam	54
Credit	-
Credit with a grade	-
Term papers	no

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

5.1. Thematic plan of the discipline (module)

№	Section (topic) disciplines and short Table of Contents	Emerging competencies, indicators	Full-time				Current Forms control Academic Performance
			Contact work of students with the teacher / of them in the form of practical training, hours			Independe nt work, hours	
			Lectures	Laboratory work	Practical exercises		
Semester 6							
1	Classification of knowledge. Subject area research	PC-1, PC-2				10.00	Interview
2	Identification of knowledge in artificial intelligence systems. Fuzzy logic. Formation of belonging functions in the Fuzzy Logic Toolbox software environment	PC-1, PC-2			6.00	10.00	Interview
3	Model Building in Artificial Intelligence Systems (Prolog Declarative Language)	PC-1, PC-2			4.00	10.00	Interview
4	Products in Artificial Intelligence Systems	PC-1, PC-2			6.00	10.00	Interview

5	Knowledge Frame Models	PC-1, PC-2			4.00	10.00	Interview
6	Neural Networks in Artificial Intelligence Systems. Approximation of Neural Network Functions	PC-1, PC-2			4.00	16.00	Interview
	Exam preparation					54.00	
	TOTAL for the 6th semester				24.00	66.00	

6. Fund of assessment tools for current monitoring of progress and intermediate certification of students in the discipline (module)

The Assessment Tools Fund (ASF) for the current monitoring of progress and intermediate certification of students in the discipline (module) "Fundamentals of Management Theory" is based on the list of competencies to be mastered with an indication of the stages of their formation in the process of mastering the discipline (module). The CSF provides objective control over the achievement of the planned learning outcomes. The CSF includes:

- 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) experience of activity, characterizing the stages of competence formation;
- standard control tasks and other materials necessary to assess knowledge, skills and the level of mastery of the formed competencies in the process of mastering the discipline (module).

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 classes are conducted in order to consolidate the learned information, to acquire skills for 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 work, as well as performing 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:

Korobko, V. I.; Management Theory Electronic resource: Textbook for university students studying in the specialty "State and Municipal Management", "Organization Management" / V. I. Korobko. - Management Theory, 2022-03-26. - Moscow : UNITI-DANA, 2017. - 383 p. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-238-01483-8

A. A., Shestopalov M. Yu., Khalikov M. I. : textbook. - St. Petersburg: SPbGLTU, 2012. - 112 p. - ISBN 978-5-9239-0511-3, unlimited copies

Salmina, N.Yu.; Functional programming and intelligent systems Elektronnyi resurs : uchebnoe posobie [Functional programming and intelligent systems]. - Tomsk: Tomsk State University of Control Systems and Radioelectronics, 2016. - 100 p. - The book is in the basic version of the EBS IPRbooks., copies are unlimited

Intelligent systems for designing and managing technical objects in 4 parts. Part 3 : textbook / V. A. Nemtinov, S. V. Karpushkin, V. G. Mokrozub [i dr.]. - Intelligent systems for designing and managing technical objects in 4 parts. Part 3, 2025-04-06. - Electron. dan. (1 file). - Tambov : Tambov State Technical University, EBS ASV, 2018. - 152 p. - electronic. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-8265-1971-4 (part 3), 978-5-8265-1608-9, unlimited copies

Intelligent systems for designing and managing technical objects. In 4 parts. Part 4 : textbook / V. A. Nemtinov, S. V. Karpushkin, V. G. Mokrozub [i dr.]. - Intelligent systems for designing and managing technical objects. In 4 parts. Part 4, 2026-10-15. - Electron. dan. (1 file). - Tambov : Tambov State Technical University, EBS ASV, 2020. - 196 p. - electronic. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-8265-2207-3 (part 4), 978-5-8265-1608-9, unlimited copies

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

Chupin, A. V.; Intelligent systems of automated control Elektronnyi resurs / Chupin A. V. - Kemerovo : KemSU, 2016. - 108 p. - ISBN 978-5-89289-951-2, unlimited copies

Trofimov, V.B.; Intelligent Automated Control Systems of Technological Objects: Educational and Practical Manual / V.B. Trofimov, S.M. Kulakov. - Moscow|Vologda : Infra-Engineering, 2016. - 232 p. : ill., tabl., schemes. - <http://biblioclub.ru/>. - References: p. 183-193. - ISBN 978-5-9729-0135-7, unlimited copies 8.1.2. List of additional references:

Muzyleva, I. V.; Theory of Automatic Control. Linear Systems Electronic resource: Guidelines for Practical Classes / I. V. Muzyleva, A. A. Muravyov. - Lipetsk : Lipetsk State Technical University, EBS ASV, 2013. - 84 p. - The book is in the premium version of EBS IPR BOOKS. - ISBN 978-5-88247-613-6

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

<http://model.exponenta.ru> – Site of the Theory of Automatic Control, Educational and Methodological Complex

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 (module), including a list of software and information reference systems

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

Information reference systems:

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

1. <http://model.exponenta.ru> – Site of the Theory of Automatic Control, Educational and Methodological Complex

Software:

1. Viola Workstation 10
2. Alt Workstation K
3. Viola "Server"
4. Office software package - 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 provides all types of disciplinary and interdisciplinary training, laboratory, research work of students (portable laptop, portable projector, computers with the necessary software and Internet access).

Lectures	1	The classroom for lecture-type classes is equipped with specialized furniture and technical teaching aids that serve to present educational information to a large audience: a laptop, a projector. Educational and visual aids in the form of thematic presentations corresponding to the work programs of disciplines.
Practical exercises	1	Room 9-520, equipped with equipment and technical means of training for the presentation of educational information: - Interdisciplinary laboratory platform with NI ELVIS II + Circuit Design software kit – 10 pcs. (with the laboratory complex "Fundamentals of Radio Engineering and Telecommunications", the laboratory module "Fundamentals of Digital Engineering and FPGA Programming"); - 12 workstations included: Dell Intel Core i3-3240 3.4GHz/4096Mb/500Gb/ DVD-RW/ keyboard/mouse, DELL E2014H monitor. Connection to the Internet, access to the university's corporate network.
Independent work	1	The room for independent work of students is equipped with computer equipment with the ability to connect to the Internet and provide access to the 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 (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 teaching materials of the discipline (the work program of the discipline, assessment and methodological materials, forms of certification), implemented with the use of distance educational 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.