

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
Federal State Autonomous
educational institution of 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

Digital Signal Processing / Цифровая обработка сигналов

Direction of training	02.04.01 Mathematics and Computer Science
Profile	Training Program for Electronic Information
Year of commencement of studies	<u>2026</u>
Form of study	full-time
Implemented in the 1st semester	

DEVELOPED BY:

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Modeling, Candidate of Technical
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Stavropol, 20 26

1. The purpose and objectives of mastering the discipline:

The discipline of mathematical and software methods of signal processing under the master's program in the direction 09.04.02 Information systems and technologies (Master's program "Data The " Management " course is designed to teach master's students modern mathematical and software methods for Digital Signal Processing / Цифровая обработка сигналов. This course covers the study of discrete signals and systems, spatial and frequency representations of signals, digital filters, and digital image processing methods. To reinforce the material covered, laboratory work is provided using the modern computer mathematics system MATLAB .

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

The discipline "Digital Signal Processing / Цифровая обработка сигналов" is a discipline of the elective part of the master's degree program in the field 09.04.02 "Information systems and technologies".

1. 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
UK-2 is capable of managing a project at all stages of its life cycle.	ID-1 _{UK-2} As part of the project activities, it models the technological processes of creation and processing of materials taking into account economic factors and in accordance with the requirements of environmental and industrial safety	Formulates the project's goal and creates a project passport
	ID-2 _{UK-2} Implements a new project into production and manages it at all stages of its life cycle	Develops an action plan for project management at all stages of its life cycle and creates a project portfolio
OPK-2 is capable of conducting methodological and expert work in the field of mathematics and computer science.	ID-1 _{OPK-2} Searches for system software, understands the structure of the operating system, the purpose of the main parameters and components of the operating system; uses methods for installing system software, as well as the modes of its interaction with the operating system; selects methods for monitoring operating system components, as well as fault-tolerant configuration modes	Demonstrates a confident command of modern mathematical models applicable to the natural sciences. Develops and substantiates original mathematical models for describing natural phenomena and processes.
	ID-2 _{OPK-2} Installs and uninstalls the Windows operating system , deploys the Windows directory service , and configures server roles; installs and uninstalls system software, starts, stops, and	Demonstrates excellent knowledge of current concepts, theories and methods, their history and modern development trends. Independently formulates

	configures Windows services, and uses a Windows -based software router ; diagnoses the causes of Windows operating system failures using system software	and justifies new concepts, theories, or methods using a creative and scientifically sound approach.
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4. Volume of the academic discipline (module) and forms of control *

Volume of classes: total: 4 credits , 144 academic hours .	OFO, in academic hours
Contact work:	
Lectures/including practical training	0
Laboratory work /including practical training	0
Practical classes /including practical training	32
Independent work	58
Forms of control	
1st semester exam	54
Credit	-
Credit with grade	-
Coursework	-

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

No.	Section (topic) of the discipline and brief content	Developed competencies, indicators	full-time education				Forms of ongoing monitoring of academic performance
			Contact work of students with a teacher/of which in the form of practical training, hours			Inde pendent wo rk, ho urs	
			Lec tur es	Prac tical clas ses	La bo rat or y wo rk		
1.	Section 1. Discrete signals and systems.	ID-1 UK-2 ID-2 UK-2		8.0		14.0	Interview
2.	Section 2. Spatial and frequency representation of signals.	ID-1 OPK-2 ID-2 OPK-2		8.0		16.0	Interview
3.	Section 3. Digital filters.	ID-1 UK-2 ID-2 UK-2		8.0		16.0	Interview
4.	Section 4. Methods of digital image processing.	ID-1 OPK-2 ID-2 OPK-2		8.0		16.0	Interview
	TOTAL for 1 semester			32.0	-	58.0	

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

The assessment toolkit (AST) for a course (module) 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 (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 is structured on a thematic principle, with each topic representing a logically complete section.

Practical classes are conducted 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 practical 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. Umnyashkin S. V. Fundamentals of the Theory of Digital Signal Processing : A Tutorial . Moscow : Tekhnosfera , 2016. URL : https://biblioclub.ru/index.php?page=book_red&id=444859&sr=1
2. Rozhentsov A. A. , Baev A. A. , Chernyshev D. S. Development of signal processing devices on programmable logic integrated circuits: laboratory practical training . Yoshkar - Ola : Perm State Technical University , 2016. URL : https://biblioclub.ru/index.php?page=book_red&id=461634&sr=1

8.1.2. List of additional literature :

1. Shchetinin Yu . I. Analysis and processing of signals in the MATLAB environment : a tutorial. Novosibirsk : NSTU , 2011. URL : https://biblioclub.ru/index.php?page=book_red&id=229142&sr=1
2. Digital processing of signals and images in radiophysical applications . Moscow : Fizmatlit , 2007. URL : https://biblioclub.ru/index.php?page=book_red&id=82181&sr=1

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 "Digital signal processing." Stavropol: SKFU, 2026 .
2. Guidelines for practical classes in the discipline "Digital signal processing". 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

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

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 (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 assessment 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 discipline with the use of 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 that provide 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.