

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 of Higher Education
«NORTH CAUCASUS FEDERAL UNIVERSITY»

APPROVE

Acting Director of the Institute,
Candidate of Technical Sciences,
Associate Professor A.A. Porohnia

DISCIPLINE WORK PROGRAM

Parallel computing

Direction of training
Directionality (profile)

Starting year

Form of study

Implemented during the semester

09.04.03 Applied Informatics

Knowledge Management

2026

full-time

1

Developed

Associate Professor of the Department
(developer position)

Amirokov S.R.

S.N.P.

Stavropol 2026 y.

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

The purpose of mastering the discipline is the formation of universal and general professional competencies among students based on the development of a complex of knowledge in the field of applied informatics.

The tasks of mastering the discipline:

- possession of methods and technologies of parallel programming;
- ability to develop programs for parallel and distributed computing systems;
- the ability to create distributed algorithms and programs;
- the ability to formulate correctness properties of the behavior of distributed algorithms;

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

The discipline "Parallel computing" refers to the disciplines of the mandatory part.

3. The list of planned learning outcomes for the discipline (module), correlated with the planned results of mastering the educational program

Code, wording of competence	Code, indicator wording	Planned learning outcomes for the discipline (module), characterizing the stages of formation of competencies, indicators
UC-6 Focus on achieving results	ID-1 UC-6. achieves results through self-development.	achieves results through self-development
	ID-2 UC-6. uses goal-setting techniques.	uses goal-setting techniques
CPC-2 Able to develop original algorithms and software, including using modern intelligent technologies, to solve professional problems	ID-1 OPK-2. develop original algorithms for solving professional problems;	develops original algorithms for solving professional problems
	ID-2 OPK-2. develop software tools for solving professional problems	develops software tools for solving professional problems
PC-3, Apply and develop fundamental and interdisciplinary knowledge, scientific research methods and tools, including mathematical and scientific principles, applied computer science methods, algorithms and software packages	ID-1 PC-3. develop fundamental and interdisciplinary knowledge	develops fundamental and interdisciplinary knowledge
	ID-2 PC-3. Develop scientific research methods	develops research methods
PC-10 Ability to deploy, install, commission, maintain and administer information systems, their components and information services	ID-1 PC-10. deploy, information systems, their components and information services	deploys, information systems, their components and information services
	ID-2 PC-10 to install information systems, their components and information services	installs information systems, their components and information services

4. Scope of academic discipline and forms of control *

Volume of classes: total: 4 credits 144 acad.h.	Full-time education, in acad. hours
contact work:	
Lectures / of which practical training	18
Laboratory work / of which practical training	36
Practical training / of which practical training	
Independent work	54
Forms of control	
Exam	36
credit	
credit with an assessment	
Settlement and graphic works	
Coursework	
Test papers	

* Discipline (module) provides for the use of e-learning, distance learning technologies

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

№	Section (topic) of the discipline and summary	Formed competencies, indicators	Full-time			
			Contact work of students with a teacher / of them in the form of practical training, hours			Independent work
			Lectures	Practical training	Laboratory work	
1	History and meaning of computing	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
2	Architecture of parallel computing systems	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
3	Models of computing processes and systems	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
4	Building Estimates of Performance and Efficiency of Parallel Computers	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
5	Building parallel algorithms: an engineering approach	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
6	Algorithm parallelism detection based on graph analysis	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
7	Time characteristics of algorithms	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6

8	Parallelization of algorithms along the information graph	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
9	The simplest parallel algorithms	УК-6, ОПК-2, ПК-3, ПК-10	2		4	6
	TOTAL for 1 semester		18		36	54
	TOTAL		18		36	54

6. Fund of assessment tools by discipline (module)

The Fund of Evaluation Tools (FOS) by discipline (module) is based on the list of mastered competencies with indication of indicators. FOS provides an objective control of the achievement of the planned learning outcomes. FOS 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, abilities and (or) activity experience that characterize the stages of the formation of competencies (are included in the guidelines for those types of work that are provided for by the curriculum and provide for an assessment of the formation of competencies);
- typical assessment tools necessary for assessing knowledge, skills and the level of competence development.

FOS is an application to this discipline program.

7. Guidelines for students on mastering the discipline

Getting started, each student should take into account the following provisions.

The discipline is built according to the thematic principle, each topic is a logically completed section.

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

Laboratory work is aimed at acquiring practical experience in the relevant subject area.

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

For the successful mastering 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. The list of basic and additional literature necessary for the development of the discipline (module)

8.1.1. List of basic literature:

1. Billig, V.A. Parallel Computing and Multithreaded Programming / V.A. Billig. - 2nd ed., Rev. - Moscow: National Open University "INTUIT", 2016. - 311 p. : ill., schemes. – Access mode: by subscription. – URL: <http://biblioclub.ru/index.php?page=book&id=428948> (date of access: 03/04/2022). - Bibliography. in book. – Text: electronic..

2. Nikolaev, E.I. Parallel computing / E.I. Nikolaev; Ministry of Education and Science of the Russian Federation, Federal State Autonomous Educational Institution of Higher Professional Education "North Caucasian Federal University". - Stavropol: NCFU, 2016. - 185 p. : ill. – Access mode: by subscription. – URL: <http://biblioclub.ru/index.php?page=book&id=459124> (date of access: 03/04/2022). - Bibliography. in book. – Text : electronic.

8.1.2. List of additional literature:

1. Gergel, V.P. Theory and practice of parallel computing / V.P. Gergel. - Moscow: Internet University of Information Technologies, 2007. - 424 p. : ill., tab. – (Fundamentals of Information Technology). – Access mode: by subscription. – URL: <http://biblioclub.ru/index.php?page=book&id=233067> (date of access: 03/04/2022). – ISBN 978-5-9556-0096-3. – Text : electronic.

8.2. The list of educational and methodological support for independent work of students in the discipline

1. Gergel, V.P. Theory and practice of parallel computing / V.P. Gergel. - Moscow: Internet University of Information Technologies, 2007. - 424 p. : ill., tab. – (Fundamentals of Information Technology). – Access mode: by subscription. – URL:

<http://biblioclub.ru/index.php?page=book&id=233067> (date of access: 03/04/2022). – ISBN 978-5-9556-0096-3. – Text : electronic.

8.3. The list of resources of the information and telecommunication network "Internet", necessary for the development of the discipline

www.biblioclub.ru - Electronic library system "University Library Online"

www.eLibrary.ru - Scientific electronic library

www.iprbookshop.ru - Electronic library system IPRbooks

9. The list of information technologies used in the implementation of the educational process in the discipline (module), including the list of software and information reference systems

When lecturing, computer technology is used, presentation multimedia materials are demonstrated. In seminars and practical classes, students present presentations prepared by them during self-study hours.

Information reference systems:

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

1	https://www.garant.ru/
2	http://www.consultant.ru/

Программное обеспечение:

1	Операционная система: Astra Linux
2	P7-Офис

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

Lecture classes	Classroom for conducting training sessions, equipped with multimedia equipment and teaching aids.
Laboratory studies	The classroom for conducting seminar-type classes is equipped with specialized furniture and technical teaching aids that serve to present educational information: a projector, an interactive whiteboard. There is an Internet connection, access to the educational network of the university.
Independent work	A 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 and sign language interpreters.

Mastering the discipline (module) by students with disabilities can be organized jointly with other students, as well as in separate groups.

Mastering the discipline (module) by students with disabilities is carried out taking into account the peculiarities of psychophysical development, individual capabilities and health status.

In order to make higher education accessible to persons with disabilities in the course of mastering a discipline (module), the following is ensured:

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 a workplace, move around, read and complete the task, including taking dictation),

- written assignments, as well as instructions on the order of their implementation, are made out in an enlarged font,
- special textbooks, teaching aids and didactic materials (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 task;
- 2) for people 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 around, read and complete the task, including taking 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;
 - provided with appropriate sound means of information reproduction;
- 3) for persons with disabilities who have disorders of the musculoskeletal system (including those with severe disorders of the motor functions of the upper limbs 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 learning 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 using the information contained in databases and used in the implementation of educational programs and information technologies that ensure its processing, technical means, as well as information and telecommunication networks that ensure the transmission of the specified information over 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 between students and teachers.

The implementation of the discipline can be carried out 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, certification forms), implemented using distance learning technologies and e-learning, contain an indication of their use.

When organizing educational activities using distance learning technologies and e-learning, asynchronous and synchronous ways of implementing the interaction of 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 implementing the interaction of participants in educational relations through the information and telecommunication network "Internet" (VCS-video conferencing, ET - electronic testing); links to the electronic information and educational environment of the 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 - authors of online courses.

When organizing intermediate certification using distance learning technologies and e-learning, Methodological recommendations are used for the use of technical means that ensure the objectivity of the results when conducting intermediate and state final certification for educational programs of higher education - bachelor's programs, specialist's programs and master's programs using distance learning technologies (Letter of the Ministry of Education and Science of the

Russian Federation of December 7, 2020 No. MN-19/1573-AN "On the submission of methodological recommendations").

The implementation of the discipline using e-learning and distance educational technologies is carried out using the electronic information and educational environment of NCFU, which is accessible to students via the 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 using e-learning and distance learning technologies includes a work program presented in electronic form, teaching aids or a course of lectures, methodological instructions for performing 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 the NCFU.