1	Computing Systems
2	Software Development Technology
3	Modern numerical methods
4	Intelligent Systems
5	Foreign Language
6	The Methods of Optimization and Decision-Making in Project Management
7	Philosophy
8	Simulation of Processes and Objects
9	Security and Protection of information in information systems
10	Parallel methods and algorithms
11	System Theory and Systems Analysys
12	Computer Technologies of Analysis and Data Processing
13	Fundamentals of Scientific Research. Research Workshop
14	Intelligent data analysis and method Machine learning
15	Computer View Systems
16	Neuromorphic technologies
17	Distributed Information Systems and Databases
18	3D Graphics and Animation
19	Computer linguistics
20.1	Monitoring Systems and Networks
20.2	Standardization in the Field of Information Technology
21.1	Autonomous robots and multi-agent systems
21.2	Project management, engineering and reengineering information systems
22	Academic Internship: Orientation
23	Industrial Practice: Practice in Obtaining Professional Skills and Experience
24	Educational practice: technological (design and technological) practice
25	Industrial Internship: Research
26	Pre-Graduation Training: Research Activity
27	Preparation and Defense of Master Thesis
28	Inductive Data Analysis
29	Artificial neural networks
30	Cyberphysical systems: theory and applications

ANNOTATION OF THE PROGRAM

Economy and Basics of enterprise management

Course: 1, semester ы : 1 2

		Semester	
№	**Kind of activity**	**1**	**2**
1	Total credits	3	3
2	Total hours	108	108
3	Total classes in the contact form, hours	43	47
4	Lectures, hours	18	0
5	Practical lessons, hours	0	18
6	Laboratory studies, hours	18	18
7	of them in an active and interactive form, hours	8	0
8	Consultations, hours	5	9
9	Independent work, hours	65	61

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks
Assigns to develop and upgrade software and hardware. information and automated systems; *regarding the following learning results*:
to know the modern software and hardware and automated systems
Adapting foreign information processing complexes and automated design to the needs of domestic enterprises; *regarding the following learning results*:
To be able to: bring foreign information processing complexes in line with national standards, integrate with industry information systems

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks	
1. to know the principles of building software architecture and types of software architectures	Lections; Seminars; Laboratory works; Independent work
to know the modern software and hardware and automated systems	
2. Know Methods for calculating the established and transitional modes in autonomous power supply systems	Lections; Seminars; Laboratory works; Independent work

To be able to: bring foreign information processing complexes in line with national standards, integrate with industry information systems	
3. To be able to develop projects in the environment Programming industrial controllers	Lections; Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: History of parallelism				
1. History of parallelism. Scalar and vector information processing. Conveyor. Emm network. Systematics Flynna. The main literature on discipline and its brief analysis.		2	1	
Didactic unit: Mathematical planning of experiments for power models				
2. Class SIMD.Vector conveyor systems. MIMD class. Cluster structures.		2	1, 2	
Didactic unit: High-precision automatic control systems				
3. Concept of ATS.		4	1	
4. ABS functioning algorithms. Organization of parallel computing.	4	4	2, 3	
5. Functioning of computing systems. The main modes of operation of the aircraft. Mode of solving a complex task. Solution of set of tasks on the aircraft.	2	2	1, 2, 3	
6. Computing environments.		2	1, 2	
Didactic unit: processors				
7. Systolic and wave processors.		2	1, 3	

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Organization of parallel computing				
1. Analysis of how to determine the complexity of algorithms and workload of the controlling computing complex.	2	4	2, 3	Performing laboratory work, report preparation, protection of results.
Didactic unit: Functioning of computing systems				

2. Analysis of methods and the choice of the discipline of maintenance of tasks of the single-processor computing complex of a real scale of time.		4	2, 3	Performing laboratory work, report preparation, protection of results.
3. Analysis of the criteria for the effectiveness of the control computing complex and determining the optimal performance of the processor		6	2, 3	Performing laboratory work, report preparation, protection of results.
4. The study of routing algorithms in network architecture computing systems with a regular structure.		4	2, 3	Performing laboratory work, report preparation, protection of results.
Semester: 2				
Didactic unit: Functioning Sun				
5. Analysis of the implementation of typical exchange schemes on the RVS with a trunk channel (half-duplex).		4	1, 3	Performing laboratory work, registration of the report, protection of results.
6. Analysis of the implementation of typical exchange schemes on the RVS with the main channel (duplex).		4	3	Performing laboratory work, registration of the report, protection of results.
7. Analysis of the implementation of typical exchange schemes on the RVS of the ring structure (duplex).		4	3	Performing laboratory work, registration of the report, protection of results.
8. Development and analysis of the R-algorithm of solutions Slava for the RVS of the linear structure.		6	3	Performing laboratory work, registration of the report, protection of results.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Functioning Sun				
1. Development and analysis of the R-algorithm of solutions Slava for RVS with a main channel.		4	2, 3	Performing a practical task, registration of the report, protection of the results.
2. Development and analysis of the P-algorithm for multiplication of matrices for RVS with a trunk canal.		6	3	Performing a practical task, registration of the report, protection of the results.
3. Analysis of the stages of the implementation of P-algorithms on the RVS.		4	1, 2, 3	Discussion on the topic. Performing a practical task, registration of the report, protection of the results.
4. Development and analysis of the P-algorithm for multiplication of matrices for the RVS of the ring structure.		4	2, 3	Performing a practical task, reporting. Discussion.

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Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Microsoft Office Application Pack

2 Operating System Microsoft Windows

ANNOTATION OF THE PROGRAM
Software development technology

Course: 1, semester ы : 1 2

		Semester	
№	**Kind of activity**	**1**	**2**
1	Total credits	2	4
2	Total hours	72	144
3	Total classes in the contact form, hours	42	46
4	Lectures, hours	18	18
5	Practical lessons, hours	18	0
6	Laboratory studies, hours	0	18
7	of them in an active and interactive form, hours	8	0
8	Consultations, hours	4	8
9	Independent work, hours	30	98

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Own: methods for developing original software, including using modern information and intellectual technologies, to solve professional tasks
Assigns to develop and upgrade software and hardware. information and automated systems; *regarding the following learning results*:
To be able to calculate and select individual elements of the electric drive systems
is able to develop the components of software and hardware processing complexes of information and auto Omatized design; *regarding the following learning results*:
own: methods for compiling technical documentation for the use and use and Setting the components of a software and hardware complex
To be able to: analyze the technical task, develop and optimize the program code to solve information processing tasks and automated design
Adapting foreign information processing complexes and automated design to the needs of domestic enterprises; *regarding the following learning results*:
own: methods for setting up the interface, development of user templates, connecting libraries, adding new features
Can carry out effective management of software development and projects; *regarding the following learning results*:
Know: Methods and Means of Software Development, Software Development Project Management Methods, Project Data Organization Methods, Regulatory Documents (Standards and Regulations) to develop software and projects
own: methods of developing technical specifications, drawing up plans, distribution of tasks, testing and evaluation Your software
to be able to: choose means of development, evaluate the complexity of projects, plan resources, monitor the execution time and Evaluate the quality of the result obtained.
is able to manage the project at all stages of its life cycle; *regarding the following learning results*:

Know: Project Management Methods; Stages of the project's life cycle

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Own: methods for developing original software, including using modern information and intellectual technologies, to solve professional tasks	
1. OPK-2. 3 3. To own: methods for developing original software, including using modern information and intellectual technologies, to solve professional tasks	Lections; Laboratory works; Independent work
Know: Project Management Methods; Stages of the project's life cycle	
2. UK-2. 1 1. Participates in the management of the project at all stages of the life cycle	Lections; Seminars; Independent work
To be able to calculate and select individual elements of the electric drive systems	
3. OPK-5. 2 2. To be able to develop software and hardware of information and automated systems for solving professional tasks	Lections; Laboratory works; Independent work
To be able to: analyze the technical task, develop and optimize the program code to solve information processing tasks and automated design	
4. OPK-6. 2 2. To be able to: analyze the technical task, develop and optimize the program code to solve information processing tasks and automated design	Lections; Seminars; Laboratory works
own: methods for compiling technical documentation for the use and use and Setting the components of a software and hardware complex	
5. OPK-6. 3 HOLD: Methods for compiling technical documentation for using and configuring components of the software and hardware complex	Seminars
own: methods for setting up the interface, development of user templates, connecting libraries, adding new features	
6. OPK-7. 3 3. To own: using the interface settings, user template development, library connection, adding new features	Laboratory works
Know: Methods and Means of Software Development, Software Development Project Management Methods, Project Data Organization Methods, Regulatory Documents (Standards and Regulations) to develop software and projects	
7. OPK-4. 2 2. Demonstrates knowledge of applications, properties, characteristics and methods for studying electrical materials, chooses electrical materials in accordance with the required characteristics	Lections; Laboratory works
to be able to: choose means of development, evaluate the complexity of projects, plan resources, monitor the execution time and Evaluate the quality of the result obtained.	
8. OPK-8. 2 2. To be able to: choose the development tools, evaluate the complexity of projects, plan resources, monitor the execution time and evaluate the quality of the result obtained.	Lections; Seminars; Laboratory works
own: methods of developing technical specifications, drawing up plans, distribution of tasks, testing and evaluation Your software	
9. OPK-8. 3 3. To own: methods for developing technical specifications, drawing up plans, distribution of tasks, testing and assessment of software quality	Lections; Seminars

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Life cycle software. Phases and disciplines				

1. Modeling in the processes of the life cycle. UML		2	2, 7, 8	Lecture: Types of models. The essence of UML as modeling means. UML structure, static and dynamic components. Composite elements: entity, relationships, diagrams.
2. Basics of life cycle software and methodology of software engineering		2	2	Lecture: SWEBOK Software Engineering List Life Cycle Program and Project Program Engineering. "Light" and "heavy" models of software development processes. OB-VOR: "How it will work out", Gosta, Rup, Agile, XP. Life cycle models. Cascade, iterative and spiral model. Organizational and technological components of the life cycle.
3. Unified process as the basis of software engineering methodology. Phases and disciplines. Flexible methodologies and practices.		2	2, 7, 9	Lecture: Unified UP process. Life cycle phases: start, refinement, build-up, implementation. The content and results of the phases. Iteration and its workflows: requirements, analysis, design, implementation, testing, their content. Extreme and programming and Agile. Manifesto Extreme Programming (XP). Flexible (Agile) technology. SCRUM as a technological-gic framework ..
4. Business analytics. System analytics. Functional architecture as a system of artifacts of business and system analytics.		4	2, 7, 9	Lecture: modeling of the subject area and business processes. Business processes, flow diagrams of the data model. Requirements. Methods for extracting and filtering requirements. Actors and roles. Precedents. Detection of actors and precedents: business model of the subject area, model of requirements, glossary of the project. Chart of precedents, detailing of precedents, specifications of precedents. Artifacts of system analytics. The practice of developing models of the subject area, models of precedents and requirements. Functional architecture as a system of artifacts of business and system analytics.

5. Designing a graphical interface.		2	7	Lecture: Designing a graphical interface (GUI). Main aspects. Architectural design based on the GUI. Factors characterizing GUI: productivity, human errors, training, subjective perception, memorization, search, visualization, navigation. Communication of the graphical interface with other artifacts of system analytics. Design from GUI. GUI models, GUI design errors.
6. Architecture software. Discipline - Design (Software Design)		2	2, 7, 8, 9	Lecture: The concept of architecture. Multidimensional, architectural species: Model 4 + 1. Architecture as a presentation system: presentation of classes, processes, implementation, deployment and precedents (requirements). Architectural disappearance between functionality and implementation. Architectural aspects of the process of design (by SWEBOK). Modeling architecture. Analysis classes. Classes: border, control, entity. Detection of analyzing classes. Sustainability charts.
7. Practice of architectural design		2	2, 7, 8, 9	Lecture: Architectural classes and sales classes. Design "From Code". Project frame. Refactoring. Reengineering. The role of the design of AD HOC in architecture. Architectural solutions. Multilayer application model and client-server system. Layers. Interfaces. Network interaction protocols between layers. Distributed systems. Types of synchronous and asynchronous interaction. Projections of the functionality for architectural classes: view, controllers (behavior), model: business objects, ORM / DAO, database, business layer API.
8. Project management. Project metrics and software code.		2	8	Lecture: Project Management in a unified process and flexible methodologies. Assessment of labor intensity and risks. Project planning on the study phase. Software metrics.
Semester: 2				
Didactic unit: Design and design technology software				

9. Java. Architecture platform-independent runtime environment.		2	1	Lecture: JVM. Structure and stages of software code assembly. Meta-level. Dynamic loading and binding of classes. Reflection. Collecting garbage. Control over the program.
10. Java. The main components of the Paradigm of the OOP.		2	1, 3	Lecture: language components. Classes. Objects. Primitive and reference types. Access rights. Inheritance. Polymorphism. Interfaces and abstract classes. Collecting garbage.
11. Java. Technological components of the language.		2	1, 3, 4	Lecture: Exceptions. Error processing patterns: reflection. Its use in serialization and DAO. Parallelism. Threads. Synchronization. Tools of synchronization and patterns of parallelism. I / O streams. Physical, text and binary streams.
12. Java. Technological methods of event and asynchronous programming.		2	1, 3, 4	Lecture: nested and anonymous classes. The appearance of the current object and the parent object. Using nested classes to create interacting streams, callback calls and event handlers. Event processing in Java. Event classes, interfaces of listeners, announcement of events. Methods for creating event handlers: Functional programming. Lambda expressions in Java.
13. Design templates as the level of modularity and control of the code.		4	1, 3, 4	Lecture: Design templates. Producing templates Structural templates Behavioral templates System templates Paralylism templates
14. Scala as the technological heir C ++ and Java		2	1, 3, 4	Lecture: Scala. Basic ideas. Architecture. Syntax. Classes and objects. Direct and reverse interaction of SCALA - Java code. Templates (Generic) as a base element Scala. Arrays as objects. Designers. Syntax. Transfer of parameters while inheritance. Increased meta-model of the language. Functions as classes, constants like objects, operations as methods (redefinition of operations). Object model language.

15. Scala as implementing a functional programming paradigm		2	1, 3, 4	Lecture: Scala. Functions as parameters. Anonymous functions. Scala. Type containers (monadys). Control in inheritance types. Variability. Covariance and counterperity. Data structure. Operations on them. Functional combiners. Imperative and functional programming style in Scala.
16. Development of Java applications for Android		2	1, 3, 4	Lecture: Android OS architecture. Development system for Android. The structure of the application. File androidmanifest.xml. Description Component (actions, services) and permits. Activity class. Classes of image elements and layout managers. Static design markup in XML files dynamic (software markup). Features of execution of applications related to resource constraints.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Design and design technology software				
1. Design of data structures on Java		6	1, 3, 4, 7, 8	Lab. Job: Studying the development environment, project management, editing and debugging programs. Port one of the data structures given in Ermak.cs.Nstu.ru/cprog. Set of operations for data structure: add to the end, receipt, insert and delete by logical number (index). Iterator foreach, sorting. Data structure is implemented as a template. To sort and orderly insert, implement one of the ways of comparison: the parameter derived from Comparable (Java) or ORD (SCALA), the parameter is an external comparison function (SCALA) or a callback interface. Check on objects - lines (randomly generated). Test Main creates an object and performs a sequence of a fixed sequence of operations.

2. Development of the window application on Java		4	1, 6	Lab. Work: Develop a window application that works with the data structure. Functions: Displays the status (content), all operations, saving and loading from a textual (binary) file.
3. Development of data structures on Scala		4	1, 3, 4, 6	Lab. Work: Port from Java Designed in L.R.1 software code. Sorting to implement using the technique of functional programming.
4. Development of the window application on Scala		4	1, 3, 4, 6, 7	Lab. Work: Develop a window application that works with the data structure. Functions: Displays the status (content), all operations, saving and loading from a textual (binary) file. Implementation options: - Window classes in Scala - Scalafx - manual generation of marking in Scala using Java classes (AWT or Javax) - Window classes in Java, Transferring events from the Scala class to Java via the callback interface (Callback)

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Life cycle software. Phases and disciplines				

1. Development of the model of the subject area	2	4	2, 4, 5, 8, 9	Practice: For the selected option, develop documents of the project research phase. Contents of the document "Vision Project": - glossary for significant items of the subject area; - business requirements; - project borders; - a list of stakeholders, project users and applications; Document - Description of business processes of the subject area. - verbal description of the business processes of the subject area; - a formal description of a separate business process in the form of a data stream diagram, activity charts or means; Simulation of the subject area. System analytics. Taking into account the boundaries of the system, determine all the essence of the subject area and the relationship between them, presented in the software system by consideration of their relationships and behavior. Documents: - chart of object classes - status charts for entities having a "history" in the system
2. Development of a precedent model.	2	4	2, 4, 5, 8, 9	Practice: Develop a complete model of precedents, briefly describe the roles and content of precedents, paint scripts 2-3 most significant precedents based on the model of the subject area
3. Development of requirements	2	4	2, 4, 5, 8, 9	Practice: Determine the full list of functional and non-functional requirements for the system in the form of a hierarchical reference book. Develop a document "Specification requirements for software".

4. Development of a layout of a graphical interface	2	4	4, 5, 9	Practice: For all applications, taking into account their functionality and the existing precedents, develop a system of windows of the graphical user interface (GUI), a chart of window classes or bond graph. Justify the decisions made by the requirements from the "Software Specifications Specification". Complete the specification based on the design.
5. Development of the final document "Functional Architecture of the System"		2	4, 5, 9	Practice: On the basis of documents compiled upon the execution of the lab. Working to draw up a final description of the functional architecture of the system.

Literary sources

Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Simulation of IP Life Cycle Speed ??Specifier Software Projects and Staruml Design

2 Java IDE JetBrains Intellij Idea - Java IDE
Intellij Idea

3 Wednesday to solve statistical tasks Statistica StatSoft Statistica

4 Python

ANNOTATION OF THE PROGRAM
Modern numerical methods

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	4
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

Adapting foreign information processing complexes and automated design to the needs of domestic enterprises; *regarding the following learning results*:
Know: Functional requirements for application software to solve topical tasks of industry enterprises, national standards for processing information and automated design

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Functional requirements for application software to solve topical tasks of industry enterprises, national standards for processing information and automated design	
1. OPK-7. 1 1. Know: Functional Requirements for Applied Software to solve the urgent tasks of enterprises of the industry, national standards for processing information and automated design	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 3				
Didactic unit: Numerical methods of solving applied tasks				

1. Mathematical models, mathematical tasks, computational algorithms and the foundations of computer tasks algorithm. Modern application packages		4	1	Lecture: Mathematical models, examples of their construction, basic concepts. The formulation of mathematical tasks using mathematical modeling. The concept of the algorithm, the construction of iterative (computing) algorithms and the features of their computer implementation. Mathcad, Matlab, Excel.
2. Equations and methods for their numerical solution		4	1	Lecture: Examples of nonlinear algebraic and nonalgebraic equations. Setting the task of an approximate (iterative) solution of these equations. Finding the root isolation intervals. Iterative methods for finding a root at a well-known insulation interval. Method of dividing the segment in half (dichotomy). Horde method. Newton method (tangent). Chebyshev method. The method of sequential. Method of simple iteration (MPI). An example of using standard MathCAD package functions.
3. Methods for solving systems of linear algebraic equations		2	1	Lecture: The concept of a system of linear algebraic equations (Slava). Examples of the occurrence of the Slava in solving mathematical tasks in various applications. Direct (accurate) and iterative (approximate) methods of solving Slava. A brief overview of the accurate methods. Solution of the Slava method of ordinary iterations. Zeidel method. Standard MathCAD package functions: Given / Find computing unit, built-in LSOLVE function.

4. Interpolation and approximation of functions		2	1	Lecture. The concept of interpolation. The task of restoring the function. The task of approximation of the function. Partly permanent interpolation. Piece and parabolic interpolation. Cubic interpolation spline. Built-in MathCAD package functions for building a cubic interpolation spline Interp, CSPline, PSPline, LSPLINE. Interpolation polynomial Lagrange. An example of building a Lagrange polynomial. Method of least squares (MNC)
5. Numerical differentiation and integration.		2	1	Lecture: The concept of numerical differentiation, searching a derivative of a table specified function. Numerical differentiation using approximation (linear interpolation, Lagrange polynomial, spline function, etc.). Numerical differentiation using end differences. Using standard MathCAD functions for differentiation. The concept of numerical integration. Construction of the formulas of approximate integration (quadrature formulas). The general formula of rectangles. Formulas of the left and right rectangles. Formulas of the trapezium and simpson. Using standard MathCAD functions for integration.
6. Numerical solution of ordinary differential equations	2	2	1	Lecture. The concept of a differential equation. Ordinary Differential Equations (ODU). Examples of tasks in which ODU arise. The task of moving the system of interacting material points. Tasks of chemical kinetics, electrical chains, resistance of materials. Numerical methods for solving the Cauchy problem. Euler method. Runge-Kutta methods. The boundary value task is for the second order ODU. The decision of the ODU and the ODE systems in the MathCAD package.

7. Numerical solution of partial derivative equations	2	2	1	Lecture. The basic concepts of equations in private derivatives. Parabolic equations, hyperbolic equations, Poisson equations. Using the capabilities of the MathCAD package to solve emerging tasks.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Numerical methods of solving applied tasks				
1. Solution of nonlinear algebraic equations		4	1	Laboratory work: Solution of nonlinear algebraic equations Solving systems of linear algebraic equations
2. Interpolating functions. Approximation of functions		4	1	Laboratory work: Interpolization of functions using splines Approximation of functions using the smallest square method
3. Numerical integration		4	1	Laboratory work. Numerical integration using various options for quadrature formulas
4. Numerical solution of ordinary differential equations		6	1	Laboratory work. Numerical solution of ordinary differential equations by Euler and Runge-Kutta methods

Literary sources

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Methodical support and software

Methodological support

1. Зыбарев В. М. Вычислительная математика (для набора 2019 и последующие) [Электронный ресурс] : электронный учебно-методический комплекс / В. М. Зыбарев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242871. - Загл. с экрана.

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Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

2 PTC Mathcad

ANNOTATION OF THE PROGRAM
Intelligent systems

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	5
2	Total hours	180
3	Total classes in the contact form, hours	66
4	Lectures, hours	36
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	10
9	Independent work, hours	114

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks	
1. communication and interaction styles	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**
Semester: 1			
Didactic unit: Application intelligent systems			

1. Overview of the development trends of the direction of artificial intelligence in Russia and in the world		2	1
2. The main components of intelligent systems		4	1
3. Generalized structure of the intellectual system		4	1
4. Robotic systems: Review of the state and development prospects		2	1
Didactic unit: Knowledge view models			
5. Review and classification of knowledge presentation models		4	1
6. Information search systems: basic principles of development, creation and use		4	1
Didactic unit: Models and methods for extracting and formalizing knowledge			
8. Methods and objectives of machine learning. Neural networks		4	1
9. Analysis of the natural language in modern intelligent systems		4	1
Didactic unit: Management of software projects			
11. Issues of choosing methods for extracting and presenting knowledge to develop intellectual systems in various subject areas		4	1
12. Overview of existing technologies for developing intelligent systems		4	1

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Knowledge view models				
7. Application of neural networks to solve the task of classification and image recognition	4	8	1	Creating neural networks to solve the task of classification and recognition of images in accordance with the option
Didactic unit: Models and methods for extracting and formalizing knowledge				
10. Application of machine learning methods for solving clustering problems and approximate dependencies	4	10	1	Solving problems of clustering and approximate dependencies using machine learning methods in accordance with the option

Literary sources

Main literature

1. Шахмаметов Р. Г. Распределенные системы искусственного интеллекта : учебное пособие : [для 4 курса дневного отделения (направление 230100 " Информатика и вычислительная техника") и заочного отделения (направления 230102 "Автоматизированные системы обработки информации и управления)] / Р. Г. Шахмаметов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 154, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000077645. - Инновационная образовательная программа НГТУ "Высокие технологии".

2. Гриф М. Г. Гибридная экспертная система проектирования человеко-машинных систем и принятия решений ИНТЕЛЛЕКТ-3 : учебное пособие / М. Г. Гриф ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 182, [1] с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000076706. - Инновационная образовательная программа НГТУ "Высокие технологии".

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4. https://e.lanbook.com/

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6. http://znanium.com/

Methodical support and software

Methodological support

1. Системы искусственного интеллекта: введение в основы разработки и создания робототехнических систем : методические рекомендации к лабораторным работам для 3-5 курсов АВТФ специальностей 230101 и 230105 по направлению 230100 (очной и заочной форм обучения), школьников 10-11 классов, для специалистов второго высшего образования / Новосиб. гос. техн. ун-т ; [сост. И. Н. Швайкова]. - Новосибирск, 2014. - 25, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000207899

2. Системы искусственного интеллекта : методические указания к выполнению лабораторных работ для 4 курса ФПМИ по специальностям 050500, 050503, 080801 дневного отделения / Новосиб. гос. техн. ун-т ; [сост.: В. М. Волкова, И. А. Цильковский]. - Новосибирск, 2011. - 70, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000151394

3. Разработка прототипа интеллектуальной информационной системы : методические указания к выполнению контрольной работы для студентов 4 курса заочного факультета по дисциплине "Интеллектуальные информационные системы" / Новосиб. гос. техн. ун-т ; [сост. О. В. Милёхина]. - Новосибирск, 2010. - 37, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000135202

4. Гриф М. Г. Интеллектуальные системы [Электронный ресурс] : электронный учебно-методический комплекс / М. Г. Гриф ; Новосиб. гос. техн. ун-т. - Новосибирск, [2013]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000183222. - Загл. с экрана.

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Foreign language

Course: 1, semester ы : 1 2

		Semester	
№	**Kind of activity**	**1**	**2**
1	Total credits	3	2
2	Total hours	108	72
3	Total classes in the contact form, hours	45	43
4	Lectures, hours	0	0
5	Practical lessons, hours	36	36
6	Laboratory studies, hours	0	0
7	of them in an active and interactive form, hours	36	0
8	Consultations, hours	7	5
9	Independent work, hours	63	29

External requirements

Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
Know: Modern Communicative Technologies in Public and Foreign Languages; regularities of business oral and written communication
own: methodology for interpersonal communication in public and foreign languages, using professional language forms and means

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Modern Communicative Technologies in Public and Foreign Languages; regularities of business oral and written communication	
1. Modern communicative technologies in a foreign language; Patterns of business oral and written communication	Seminars
2. Language and speech features of the business, scientific style of speech in a foreign language and apply these knowledge in practice in business and professional communication.	Seminars; Independent work
own: methodology for interpersonal communication in public and foreign languages, using professional language forms and means	
3. use of joint development technologies of software complexes	Seminars; Independent work
4. Express the selection of language funds of a foreign language for effective professional and business communication.	Seminars; Independent work

5. read and understand the literature towards training with a dictionary and without a dictionary; Extract from literature on professional communication with significant information and conduct its analytical syntactic processing	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Reading, Speaker				
1. History of science	12	12	1, 2, 3, 4	Reading and translation of text in the direction of preparation and acquaintance with the terminology of the research area. Discussion of the issues of the history of the development of the research area, its subsections, basic concepts and achievements. Preparation of monologic and dialogic statements on the topic. Listening to text in the direction of training. Performing exercises that prevent listening and checking understanding
Didactic unit: Reading, speaking, letter				
2. Master program	12	12	1, 2, 3, 4	Reading the text about the program of master's training in NSTU and abroad, discussion of goals, tasks, structures and requirements for programs. Dating with the language units and means necessary to discuss this topic and the construction of a monologue statement. Familiarity with the structure of the Project Summary genre and language means for writing it. Writing a multiple description of the planned scientific research (Project Summary).
Didactic unit: Numerical methods				
3. Scientific literature	12	12	1, 2, 3, 4, 5	Reading and translation of professional-oriented texts in the direction of preparation from foreign to Russian. Acquaintance and discussion of lexico-grammatical features of business and scientific speech. Acquaintance with the abstract and abstract structure. Writing a general descriptive annotation and an informative monographic special abstract.
Semester: 2				

Didactic unit: Reading, Speaker				
4. Scientific Conference	12	12	1, 2, 3, 4	Reading, translation of text on the topic, discussion of the benefits of participation in the International Scientific Conference. Acquaintance with the information presented on various sites of international conferences, discussion of goals, objectives, structures and organizations, conference sections. Consideration of various forms and conditions of participation in the conference.
Didactic unit: Reading, speaking, letter				
5. Scientific publication	12	12	1, 2, 4	Consideration of various forms of participation in the conference. Acquaintance with the requirements for publication within a specific conference. Acquaintance with the structure of theses and language means necessary for writing this genre in a foreign language. Writing theses on the topic of the study of the undergraduate. Acquaintance with the features of correspondence in a foreign language. Writing in a foreign language response to a letter invitation to participate in the conference.
6. Report at the conference	12	12	1, 2, 3, 4	Acquaintance with the structure of the genre of the report and the language means necessary for writing the text of the report and its oral presentation in a foreign language. Writing the text of the report and oral presentation with the presentation of the results of the study of the undergraduate as part of the business game "Meeting of the Conference Section".

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Numerical methods				

1. Scientific literature on research		56	3, 4, 5	Reading and translation of professional-oriented texts on the topic of the research work of a undergraduate from a foreign language into Russian. Drawing up a glossary based on the material read.
Semester: 2				
Didactic unit: Numerical methods				
2. Scientific literature on research		22	3, 4, 5	Reading and translation of professional-oriented texts on the topic of the research work of a undergraduate from a foreign language into Russian. Drawing up a glossary based on the material read.

Literary sources

Main literature

1. ЭБС IPRbooks [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://www.iprbookshop.ru/. - Загл. с экрана.

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6. Деловой английский для магистрантов [Электронный ресурс] : электронный учебно-методический комплекс / А. Ю. Алябьева, Т. В. Волошина, А. А. Гетман, С. Ю. Полянкина, Е. А. Шестера // Электронно-библиотечная система НГТУ. – Новосибирск, 2015. – Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000213546. – Загл. с экрана.

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8. Английский язык. Аннотирование и реферирование научного текста : электронный учебно-методический комплекс / М. Н. Гордеева, О. С. Атаманова, К. В. Пиоттух, Ю. В. Ридная, Н. А. Сапченко / - Новосиб. гос. техн. ун-т, 2017. - URL: http://dispace.edu.nstu.ru/didesk/course/show/7432.- Режим доступа для авторизованных пользователей.

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Methodical support and software

Methodological support

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2. Английский язык. Аннотирование и реферирование. Ч. 1 : методические указания для магистрантов технических специальностей / Новосиб. гос. техн. ун-т ; [сост. Ю. В. Ридная]. - Новосибирск, 2013. - 93, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000179190

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Specialized software

Использование специализированного программного обеспечения для изучения дисциплины не требуется

ANNOTATION OF THE PROGRAM
methods of optimization and adoption of design solutions

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

is able to independently acquire, develop and apply mathematical, natural scientific, socio-economic and professional knowledge to solve non-standard tasks, including in a new or unfamiliar environment and in the interdisciplinary context; *regarding the following learning results*:
to know: mathematical, natural science and Socio-economic methods for use in professional activities
It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
To be able to: justify the choice of modern information and intellectual technologies, develop original software to solve professional tasks

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
to know: mathematical, natural science and Socio-economic methods for use in professional activities	
1. The history and directions of development of decision-making theory, challenges of tasks and approaches to their solution for the theory of decision-making in conditions of uncertain tee, methods for solving various classes of optimization models	Lections; Laboratory works; Independent work
To be able to: justify the choice of modern information and intellectual technologies, develop original software to solve professional tasks	

2. Use models of various tasks classes and approaches to solving these tasks in the framework of decision-making theory in the conditions of uncertainty, solve the tasks of decision making theory in conditions Obstruction and uncertainties, analyze and interpret the results of solutions to the tasks of decision making	Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Models and decision-making methods in definiteness				
1. Models and methods of linear and discrete optimization		4	1	Studying material on the topic
7. Models and methods of nonlinear optimization		4	1	Study of materials on the topic
Didactic unit: Calculation of the currents of the KZ				
3. Methodology of decision making theory		3	1	Study Materials on the topic
5. Models and methods of multi-criteria optimization		3	1	Study of materials on the topic
6. Basics of the theory of anatagonistic games		4	1	Study of materials on the topic

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Models and decision-making methods in definiteness				
1. Models and methods of linear and discrete optimization		4	1, 2	Solving tasks
4. Models and methods of nonlinear optimization	4	6	1, 2	Solving tasks
Didactic unit: Calculation of the currents of the KZ				
4. Decision making in statistical uncertainty	4	4	1, 2	Solving tasks
5. Models and methods of multi-criteria optimization		4	1, 2	Solving tasks

Literary sources

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2. Казанская О. В. Модели и методы оптимизации : практикум : учебное пособие / О. В. Казанская, С. Г. Юн, О. К. Альсова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2012. - 202, [1] с. : табл., ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000173982

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Philosophy

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	16
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

is able to analyze and take into account the diversity of cultures in the intercultural interaction process; *regarding the following learning results*:
Know: Essence, Diversity and Features of Different Crops, their ratio and relationship
Own: ways to analyze disagreements and conflicts in Intercultural communication and their permission
to be able to: provide and maintain mutual understanding between students - representatives of various cultures and communication skills in the world of cultures diversity

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Essence, Diversity and Features of Different Crops, their ratio and relationship	
1. about the concepts, methods and means of the theory of information processes and systems	Lections; Seminars; Independent work
2. systemic periodization of the history of science and technology	Lections; Seminars; Independent work
3. Definition of science and scientific rationality, the difference between science from other spheres of culture, determining the concept of information and information society	Lections; Seminars; Independent work
4. The subject and object of philosophy, the difference between scientific philosophy from the unscientific, the content of the philosophical approach and the need for philosophical vision of the world	Lections; Seminars; Independent work
5. On the process of evolution of scientific knowledge	Lections; Seminars; Independent work

6. on the main concepts of science	Lections; Seminars; Independent work
7. On the main methodological concepts of modern science	Lections; Seminars; Independent work
8. Methodological concepts of science and technology, general patterns of their relationships	Seminars; Independent work
9. On the content of the philosophical theory of knowledge, the nature of philosophical problems, philosophical understanding and explanation	Lections; Seminars; Independent work
Own: ways to analyze disagreements and conflicts in Intercultural communication and their permission	
10. on the basic methods of scientific knowledge	Lections; Seminars; Independent work
11. On our own to put problem questions on the course	Lections; Seminars; Independent work
to be able to: provide and maintain mutual understanding between students - representatives of various cultures and communication skills in the world of cultures diversity	
12. own programming skills to solve project tasks	Lections; Seminars; Independent work
13. Types and classification of innovative risks	Lections; Seminars; Independent work
Own: ways to analyze disagreements and conflicts in Intercultural communication and their permission	
14. to reasonably represent the socio-humanitarian problems of science as an integral part of the culture	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: History of philosophy and science				
1. Philosophy and science of antiquity era. Philosophy and science of the era of Gothic.	0,5	2	3, 5	Drawing up a lecture constipation
3. Philosophy and science of the Renaissance. Filosophy and science of the Epoch of Enlightenment.	0,5	2	1	Drawing up a lecture constipation
4. Philosophy and science of the era of classicism.	0,5	1	1	Drawing up a lecture constipation
5. Philosophy and science of the modern era.	0,5	1	1	Drawing up a lecture constipation
Didactic unit: Synergistic Paradigm Modern Natural science.				
6. Synergetic status in the knowledge system. Synergetics - the core of postnoclastic science. Hermeneutic methods of knowledge in natural science. The use of a synergistic approach in the social sphere.	0,5	2	6	Drawing up a lecture constipation
Didactic unit: Genesis SGN				

7. Sociocultural backgrounds of the sciences on society and man. Prehistory and history of the SGN.	0,5	2	13, 2	Drawing up a lecture constipation
8. The specifics of the object and the subject of the SGN difference from natural science.		1	12, 2, 5	Drawing up a lecture constipation
9. Socio-cultural functions of the SGN.	0,5	1	12, 2, 4, 5, 9	Drawing up a lecture constipation
Didactic unit: Traditional and technogenic civilization.				
10. Values of human existence and man-made world. Scenarios of technical evolution and prospects for the development of technogenic civilization	0,5	2	1, 11, 6	Drawing up a lecture constipation
12. Traditionalism and technical progress, their interaction in the historical perspective. Equipment of post-industrial society and the semantic values of life.	1	1	1, 5, 6	Drawing up a lecture constipation
Didactic unit: The problem of a person in modern philosophy.				
13. The role of man-made factors in its formulation and decision. Technical environment and alienation of man, ways to overcome the alienation.	1	1	1, 14, 2, 5, 6	Drawing up a lecture constipation
14. Modern psychophysiological and humanitarian problems of human and technical interaction.	1	2	10, 11, 3, 4, 6	Drawing up a lecture constipation
Didactic unit: Genesis SGN				
.			7	

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: History of philosophy and science				
1. The subject of philosophy of science. The place and role of scientific rationality in culture. The main directions, schools and stages Historical development of philosophy of science. Structure and types of rationality.	1	2	1, 3, 4, 5	Reports and discussions
Didactic unit: Teaching about Genesis				
2. Monster and pluralistic concepts of being, self-organization of being. Philosophical doctrine of matter. The concept of material and ideal. Space, time, movement and development. Determinism and intenerismism.	1	2	2, 5, 6	Reports and discussions

Didactic unit: Synergistic Paradigm Modern Natural science.				
3. Dynamic and statistical patterns. Scientific, philosophical and religious paintings of the world	1	2	4, 6	Reports and discussions
Didactic unit: Genesis SGN				
4. Man and nature, science and technology. Place science and technology in public life. The concept of man-made civilization. Formational and civilization concept of social development	1	3	12, 2	Reports and discussions
Didactic unit: Traditional and technogenic civilization.				
5. Man and historical process, personality and mass. Scientific picture of the world and the meaning of human being. Philosophy of science and intercultural dialogue. Ways of Evolution and the possibility of human mind	1	2	11, 12, 5	Reports and discussions
Didactic unit: The problem of a person in modern philosophy.				
6. Science as a cultural sphere. Theoretical systematization of knowledge of reality. Items and ways of knowledge: accurate, natural, socially humanitarian, technical. Study of objective reality based on the method of scientific analysis	1	2	7, 8	Reports and discussions
Didactic unit: Criteria for selecting tests				
7. Modern science concept. Cognition, creativity, practice. Scientific and ratio of science with other areas of knowledge. Rational and irrational in cognitive activity. The problem of truth. Reality, thinking, logic and language	1	2	10, 9	Reports and discussions
Didactic unit: Scientific and unscientific knowledge				
8. Criteria. The structure of scientific knowledge, its methods and forms. Growth of scientific knowledge. Philosophy of Science and Technology	1	2	10, 2	Reports and discussions
Didactic unit: Global problems of modernity				

9. Scientific revolutions and changing types of rationality. The theory of science as a methodological concept of systematization and a logically agreed response to the problems of philosophy of science. The concept of scientific and technological progress. Socio - Natural, Cultural and Moral Development of Human Civilization	1	1	13, 14	Reports and discussions

Literary sources

Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

ANNOTATION OF THE PROGRAM
Process modeling and objects

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

is able to independently acquire, develop and apply mathematical, natural scientific, socio-economic and professional knowledge to solve non-standard tasks, including in a new or unfamiliar environment and in the interdisciplinary context; *regarding the following learning results*:
to know: mathematical, natural science and Socio-economic methods for use in professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
to know: mathematical, natural science and Socio-economic methods for use in professional activities	
1. OPK-1. 1 1. Know: Mathematical, natural science and socio-economic methods for use in professional activities	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Introduction. Main definitions and concepts, models classes, approaches to modeling, modeling environment				

1. Main definitions and concepts, classification of modeling types, main approaches to building models of dynamic systems		2	1	lecture
2. Simulation simulation (im) systems. The main definitions, restrictions and problems of using them, the main paradigms them.		2	1	lecture
Didactic unit: System-dynamic modeling				
3. System Dynamics Models: idea, principles of construction, features of implementation, examples of models		2	1	lecture
Didactic unit: Discrete-event modeling				
4. Discrete-event modeling: idea, principles of constructing modeling algorithms, examples of models		2	1	lecture
5. Mathematical foundations of discrete-event modeling: generation of random impacts on the system (methods for generating random numbers, random variables, random events, random vectors).		2	1	lecture
6. Statistical processing of modeling results.		2	1	lecture
Didactic unit: Parameters of elements and schemes SES ET				
7. Planning machine experiments with system models.		2	1	lecture
8. Comparison of alternative configurations, system building options. Optimization of the system model.		2	1	lecture
Didactic unit: Theory of mass maintenance systems, the theory of Markov random processes.				
9. Fundamentals Theory Mass maintenance system, theory of Markov random processes used in modeling systems		2	1	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: System-dynamic modeling				
1. Development and study of system speaker models in AnyLogic	2	6	1	laboratory work
Didactic unit: Discrete-event modeling				
2. Development and study of discrete-event models (modeling environment: GPSS-Studio, Extendsim, AnyLogic)	3	6	1	laboratory work
Didactic unit: Parameters of elements and schemes SES ET				

3. Implementation of machine experiments with system models and models optimization (modeling environment: GPSS-Studio, Extendsim, AnyLogic)	3	6	1	laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Introduction. Main definitions and concepts, models classes, approaches to modeling, modeling environment				
1. Basic classes of system models, examples of models		2	1	Independent study
Didactic unit: System-dynamic modeling				
2. System-dynamic modeling		4	1	Independent study
Didactic unit: Discrete-event modeling				
3. Discrete-event modeling		6	1	Independent study
Didactic unit: Parameters of elements and schemes SES ET				
4. Planning machine experiments with system models, models optimization		4	1	Independent study
Didactic unit: Theory of mass maintenance systems, the theory of Markov random processes.				
5. Analytical methods for modeling mass maintenance systems		2	1	Independent study

Literary sources

Main literature

1. Альсова О. К. Имитационное моделирование систем в среде ExtendSim : учебное пособие / О. К. Альсова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 101, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000227593

Additional literature

1. Рыжиков, Ю. И. Имитационное моделирование. Авторская имитация систем и сетей с очередями : учебное пособие / Ю. И. Рыжиков. — Санкт-Петербург : Лань, 2019. — 112 с. — ISBN 978-5-8114-3464-0. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/113404 (дата обращения: 16.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

1. AnyLogic : многоподходное имитационное моделирование [Электронный ресурс] : единственный инструмент, который объединяет системную динамику, агентное и дискретно-событийное моделирование : сайт. – Режим доступа: http://www.anylogic.ru/. – Загл. с экрана.

2. http://elibrary.nstu.ru/

3. GPSS. Имитационное моделирование систем [Электронный ресурс]. – Казань : Элина-Компьютер, 2001–2009. – Режим доступа: http://www.gpss.ru/. – Заглавие с экрана.

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6. ExtendSim. Power tools for simulation : [website] / Imagine That Inc. – San Jose, 2021. – URL: https://www.extendsim.com (date of the application: 19.02.2021). – Text : electronic.

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Methodical support and software

Methodological support

1. Альсова О. К. Имитационное моделирование информационно-вычислительных систем [Электронный ресурс] : электронный учебно-методический комплекс / О. К. Альсова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000214518. - Загл. с экрана.

Specialized software

1 Limited version of EXTENDSIM 7 Imagine That Extendsim

2 Operating System Microsoft Windows

3 Microsoft Office Application Pack

4 Wednesday of computer simulation MINUTEMAN Software GPSS World

5 Wednesday GPSS-Studio to develop discrete-event models, student at Eria

6 Wednesday AnyLogic for simulation system simulation

ANNOTATION OF THE PROGRAM

Security and Protection of information in information systems

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

is able to develop the components of software and hardware processing complexes of information and auto Omatized design; *regarding the following learning results*:
Know: hardware and information technology infrastructure platforms, types, appointments, architecture, methods for developing and administering software and hardware complexes of the object of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: hardware and information technology infrastructure platforms, types, appointments, architecture, methods for developing and administering software and hardware complexes of the object of professional activity	
1. Know the methodology for developing network software	Lections; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**
Semester: 3			
Didactic unit: Security and information protection			

1. Introduction Inform. Security in the national security system of the Russian Federation. Federal Law "On Security".		2	1
4. Classification of information security threats. Classification of sources of information security threats.		2	1
6. Causes, types, information leak channels.		2	1
7. Methods and means of ensuring the safety of information systems. Technical means, organizational and legal protection.		2	1
Didactic unit: Security of information systems			
2. State system of legal support for the protection of information in the Russian Federation.		2	1
3. National interests of the Russian Federation in the information sphere and their provision. Sources of information security threats.		2	1
5. Threats of breach of confidentiality, integrity, information availability. Models threats.		2	1
8. Evaluation of the effectiveness of information protection tools (SZI). The concept of "information security policies" of the enterprise.		2	1
9. Information systems, classification of information systems. Causes, types, information leak channels.		2	1

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Security and information protection				
1. Countering attacks on network services. Refusal and maintenance (DOS)	1	4		
2. Countering the attacks on the Web - adhesion. SQL Injection	2	4		
5. Modeling a real situation, a group of attacking against a security group.	1	2		
Didactic unit: Security of information systems				
3. Attack bruteforce. Password selection via SMTP protocol.	2	4		
4. Obtaining full control over the target machine in various ways	2	4		

Literary sources

Main literature

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Methodical support and software

Methodological support

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6. Туманов С. А. Система защиты информации от несанкционированного доступа на основе "SecretNet 7" : учебно-методическое пособие / С. А. Туманов, И. Л. Рева ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 89, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000226348

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Specialized software

Использование специализированного программного обеспечения для изучения дисциплины не требуется

ANNOTATION OF THE PROGRAM
Parallel methods and algorithms

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	5
2	Total hours	180
3	Total classes in the contact form, hours	66
4	Lectures, hours	18
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	8
8	Consultations, hours	10
9	Independent work, hours	114

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks
Assigns to develop and upgrade software and hardware. information and automated systems; *regarding the following learning results*:
To be able to calculate and select individual elements of the electric drive systems

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks	
1. OPK-2. 1 1. Know: Modern Information Engine Communication and Intelligent Technologies, Tools, Software and Technical Platforms for Solving Professional Tasks	Lections; Seminars; Independent work
To be able to calculate and select individual elements of the electric drive systems	
2. OPK-5. 2 2. To be able to develop software and hardware of information and automated systems for solving professional tasks	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Introduction to the analysis of signals and systems				
1. The main concepts of parallel programming, architecture of parallel computing systems.	0	2	1	Lecture
Didactic unit: OpenMP technology				
2. OpenMP Parallel Programming Technology	0	4	2	Lecture
Didactic unit: CUDA technology				
4. Technology support parallel programming graphic processors CUDA	0	4	2	Lecture
Didactic unit: Technology OpenCL				
6. Parallel Programming Support Technology for Heterogeneous Computers OpenCL	0	4	2	Lecture
Didactic unit: MPI technology				
8. Technology supporting parallel programming systems with distributed MPI memory	0	4	2	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: OpenMP technology				
3. Algorithms and methods of using OpenMP technology	2	9	1, 2	Practice
Didactic unit: CUDA technology				
5. Algorithms and methods of using CUDA technology	2	9	1, 2	Practice
Didactic unit: Technology OpenCL				
7. Algorithms and methods of using OpenCL technology	2	9	1, 2	Practice
Didactic unit: MPI technology				
9. Algorithms and methods for using MPI technology in parallel programming systems with distributed memory	2	9	1, 2	Practice

Literary sources

Main literature

1. Малявко А. А. Параллельное программирование на основе технологий OpenMP, MPI, CUDA : учебное пособие / А. А. Малявко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2015. - 114, [1] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000215088

2. Малявко А. А. Программное обеспечение высокопроизводительных вычислений. Ч. 1 : конспект лекций / А. А. Малявко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2013. - 97, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000182343

Additional literature

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Internet resources

1. Высокопроизводительные вычисления на WINDOWS-кластерах [Электронный ресурс] : информ.-аналитический портал. – Режим доступа: http://parallel.ru/. – Загл. с экрана.

2. http://elibrary.nstu.ru/

3. Облачные вычисления для госорганов [Электронный ресурс] // Министерство цифрового развития, связи и массовых коммуникаций Российской Федерации. - Режим доступа: https://minsvyaz.ru/ru/activity/directions/70/. - Загл. с экрана.

4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

1. Малявко А. А. Сайт дисциплины «Параллельное программирование» [Электронный ресурс] : [электронный учебно-методический комплекс] / А. А. Малявко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2010]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000163730. - Загл. с экрана.

2. Корнеев В. Д. Методические указания к курсу "Математическое обеспечение высокопроизводительных вычислительных систем" [Электронный ресурс] : учебно-методическое пособие / В. Д. Корнеев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000160466. - Загл. с экрана.

Specialized software

1 Office package Microsoft Office applications

2 Library for parallel computing Aragon laboratory MPICH2

3 Software Parallel Programming Package Method NVIDIA Programming System CUDA

ANNOTATION OF THE PROGRAM
System Theory and System Analysis

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	8
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

is able to analyze professional information, allocate in it the main thing, structure, execute and submit in the form of analytical about Zorov with reasonable conclusions and recommendations; *regarding the following learning results*:
Know: Principles, Methods and Means Analysis and structuring of professional information
is able to apply in practice new scientific principles and research methods; *regarding the following learning results*:
can: Formulate research principles, find, compare , evaluate research methods
to know: General principles of research, research methods

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Know: Principles, Methods and Means Analysis and structuring of professional information	
1. mastering the principles, methods and means of analyzing and structuring software	Lections; Independent work
to know: General principles of research, research methods	
2. Determine the characteristics of the diagrams of the modes	Lections; Seminars; Independent work
can: Formulate research principles, find, compare , evaluate research methods	
3. Formulates the technical task to implement the project	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: General principles of system and system analysis theory				
1. Principles, methods and means of analyzing and structuring software		4	1, 2	Lecture
Didactic unit: General principles of research, methods of conducting software research				
2. Principles of Research, Methods for conducting software research		4	1, 2	Lecture
Didactic unit: Microcontrollers of the SAM3S family				
3. Basic systems systems. Measurement / Evaluation of systems. Types of scale. Methods for measuring / evaluation under conditions of certainty.		4	1, 2	Lecture
Didactic unit: Methodology of structural analysis of systems				
4. Methods of organization of expertise. Methodologies of structural analysis of systems. Essence of structural analysis.		2	1, 2	Lecture
Didactic unit: System Analysis				
5. Decomposition of a problem-containing system		4	1, 2	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Microcontrollers of the SAM3S family				
1. System modeling	2	5	2, 3	Practice
2. Analysis of systems	2	4	2, 3	Practice
Didactic unit: Methodology of structural analysis of systems				
3. Methodology for building a tree of targets. Building tree causes, life cycle diagrams	2	5	2, 3	Practice
Didactic unit: System Analysis				
4. Methods of organization Expertise: Brain Attack, Delphi method, heuristic techniques	2	4	2, 3	Practice

Literary sources

Main literature

1. Сарычева О. М. Теория систем и системный анализ : конспект лекций / О. М. Сарычева ; Новосиб. гос. техн. ун-т. - Новосибирск, 2008. - 114, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000077913

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. http://znanium.com/

Methodical support and software

Methodological support

1. Мезенцев Ю. А. Теория систем и системный анализ [Электронный ресурс] : электронный учебно-методический комплекс / Ю. А. Мезенцев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000235463. - Загл. с экрана.

Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

ANNOTATION OF THE PROGRAM

Man-machine interface in automatic control systems

Course: 1, semester : 1

		Semester
№	Kind of activity	1
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
To be able to: justify the choice of modern information and intellectual technologies, develop original software to solve professional tasks
is able to analyze professional information, allocate in it the main thing, structure, execute and submit in the form of analytical about Zorov with reasonable conclusions and recommendations; *regarding the following learning results*:
Know: Principles, Methods and Means Analysis and structuring of professional information

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
To be able to: justify the choice of modern information and intellectual technologies, develop original software to solve professional tasks	
1. OPK-2. 2 2. To be able to: justify the selection of modern information and communication and intelligent technologies, develop original software to solve professional tasks	Lections; Laboratory works; Independent work
Know: Principles, Methods and Means Analysis and structuring of professional information	
2. OPK-3. 1 1. Know: Principles, Methods and Means of Analysis and Structuring Professional Information	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Introduction. Computer data analysis technologies				
1. Computer technologies solving different types of data analysis tasks in modern statistical software, Data Mining technology, Big Data technology		4	1	lecture
2. Directions for the development of methods, technologies and means of solving problems of hell		2	1	lecture
Didactic unit: Primary statistical data processing				
3. Primary data statistical methods		2	1, 2	lecture
Didactic unit: Analysis of the time series				
4. Models and methods of analyzing time series		4	1, 2	lecture
Didactic unit: Resources.				
5. Methods and models of classification and clustering of data		4	1, 2	lecture
Didactic unit: Associative data analysis				
6. Methods of associative data analysis		2	1, 2	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Primary statistical data processing				
1. Primary data statistical data in the R, Statistica package	2	4	1, 2	laboratory work
Didactic unit: Analysis of the time series				
2. Analysis of temporary rows in the R, Statistica package	2	6	1, 2	laboratory work
Didactic unit: Resources.				
3. Classification and clustering of data in the R, Statistica package	2	6	1, 2	laboratory work
Didactic unit: Associative data analysis				
4. Associative data analysis in environment R, Package Statistica	2	2	1, 2	laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Introduction. Computer data analysis technologies				

2. Computer technology solving data analysis tasks		2	1	Independent study
Didactic unit: Primary statistical data processing				
3. Primary data statistical methods		2	2	Independent study
Didactic unit: Analysis of the time series				
4. Analysis of temporary series		6	2	Independent study
Didactic unit: Resources.				
5. Solving the tasks of classification and clustering data		6	2	Independent study
Didactic unit: Associative data analysis				
6. Associative data analysis		2	2	Independent study

Literary sources

Additional literature

1. Современные методы и средства интеллектуального анализа данных : монография / [О. К. Альсова и др. ; под ред. Е. В. Рабиновича, А. А. Якименко, О. К. Альсовой] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 199 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239742

Internet resources

1. StatSoft [Электронный ресурс] : компания : сайт. – Режим доступа: http://www.statsoft.ru/. – Загл. с экрана.

2. http://elibrary.nstu.ru/

3. StatSoft [Электронный ресурс] : электрон. учеб. по статистике. – Режим доступа: http://www.statsoft.ru/home/textbook/default.htm.- Загл. с экрана.

4. https://e.lanbook.com/

5. The R Project for Statistical Computing : website. – 2021. – URL: https://www.r-project.org/ (date of the application: 12.02.2021). – Text: electronic.

6. Managing Packages for Open-Source Data Science : Live Webinar / RStudio : website. – Boston, 2021. – URL: https://rstudio.com/ (date of the application: 15.02.2021). – Text : electronic.

7. http://www.iprbookshop.ru/

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Methodical support and software

Methodological support

1. Альсова О. К. Компьютерные технологии анализа и обработки данных [Электронный ресурс] : электронный учебно-методический комплекс / О. К. Альсова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2016]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000223807. - Загл. с экрана.

2. Алетдинова А. А. Анализ данных [Электронный ресурс] : электронный учебно-методический комплекс / А. А. Алетдинова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221830. - Загл. с экрана.

Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

2 Modeling of electromagnetic processes MathWorks Matlab Simulink

3 Wednesday R-STUDIO for developing in R
4 Wednesday R for statistical Calculations

ANNOTATION OF THE PROGRAM

Basics of research activities. Scientific seminar

Course: 1, semester ы : 1 2

		Semester	
№	**Kind of activity**	**1**	**2**
1	Total credits	2	1
2	Total hours	72	36
3	Total classes in the contact form, hours	25	22
4	Lectures, hours	0	0
5	Practical lessons, hours	18	18
6	Laboratory studies, hours	0	0
7	of them in an active and interactive form, hours	0	8
8	Consultations, hours	5	2
9	Independent work, hours	47	14

External requirements

is able to independently acquire, develop and apply mathematical, natural scientific, socio-economic and professional knowledge to solve non-standard tasks, including in a new or unfamiliar environment and in the interdisciplinary context; *regarding the following learning results*:
own: methods of the theoretical and experimental study of the objects of professional activity, including in a new or unfamiliar environment and in an interdisciplinary context
To be able to: solve non-standard professional tasks, including in a new or unfamiliar environment and in the interdisciplinary context, using mathematical, natural science, socio-economic and professional knowledge
is able to analyze professional information, allocate in it the main thing, structure, execute and submit in the form of analytical about Zorov with reasonable conclusions and recommendations; *regarding the following learning results*:
own: methods for training scientific reports, Publications and analytical reviews with reasonable conclusions and recommendations
to be able to: analyze professional information, To allocate mainly, structure, design and submit in the form of analytical reviews
is able to apply in practice new scientific principles and research methods; *regarding the following learning results*:
Own: research methods for solving practical tasks of professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

To be able to: solve non-standard professional tasks, including in a new or unfamiliar environment and in the interdisciplinary context, using mathematical, natural science, socio-economic and professional knowledge	
1. OPK-1. 2 2. To be able to: solve non-standard professional tasks, including in a new or unfamiliar environment and in an interdisciplinary context, with the use of mathematical, natural, socio-economic and professional knowledge	Seminars; Independent work
own: methods of the theoretical and experimental study of the objects of professional activity, including in a new or unfamiliar environment and in an interdisciplinary context	
2. OPK-1. 3 3. To own: methods of theoretical and experimental study of objects of professional activity, including in a new or unfamiliar environment and in the interdisciplinary context	Seminars; Independent work
to be able to: analyze professional information, To allocate mainly, structure, design and submit in the form of analytical reviews	
3. OPK-3. 2 2. To be able to: analyze professional information, allocate mainly in it, structure, draw up and submit in the form of analytical reviews	Seminars; Independent work
own: methods for training scientific reports, Publications and analytical reviews with reasonable conclusions and recommendations	
4. OPK-3. 3 3. To own: methods for training scientific reports, publications and analytical reviews with reasonable conclusions and recommendations	Seminars; Independent work
Own: research methods for solving practical tasks of professional activities	
5. OPK-4. 3 3. To own: research methods for solving practical tasks of professional activity	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Directions of scientific research faculties and departments				
1. Discussion of the scientific directions of the Filter and Department		2	1, 3	Joint discussion
Didactic unit: Development of setting the task of master's research				
2. Performance of analytical review		4	1, 2, 3, 4, 5	Preparation presentation for the report. Report Discussion of the report
3. Formation of goals and objectives of master's research		4	1, 2, 3	Preparation and discussion of Materael on the topic
4. Development of the Master's Research Objective		8	1, 2, 3, 4, 5	Preparation and discussion of reports and presentations for them
Semester: 2				
Didactic unit: Planning and carrying out machine experiments with system models, model optimization				
5. Preparation of scientific article, theses of the scientific report		4	2, 3, 4, 5	Studying recommendations. Preparation of materials. Subject
Didactic unit: Review of research works				
6. Preparation of the draft abstract of master's thesis	2	4	1, 3, 4	Preparation and discussion of materials on the topic
Didactic unit: Preparation of a Master's Dissertation Project				

7. Preparation of a summarized report on the results of the first year of study and presentation to it	6	10	1, 2, 3, 4, 5	Preparation and discussion of materials on the topic

Literary sources

Main literature

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Methodological support

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2. Исаева О. А. Научно-исследовательский семинар [Электронный ресурс] : электронный учебно-методический комплекс / О. А. Исаева, М. Ю. Павлик, С. А. Поляков ; Новосиб. гос. техн. ун-т. - Новосибирск, [2016]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000229008. - Загл. с экрана.

Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM

Intelligent data analysis and method Machine learning

Course: 2, semester : 4

		Semester
№	**Kind of activity**	**4**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	43
4	Lectures, hours	20
5	Practical lessons, hours	0
6	Laboratory studies, hours	14
7	of them in an active and interactive form, hours	4
8	Consultations, hours	7
9	Independent work, hours	65

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Own: methods for developing original software, including using modern information and intellectual technologies, to solve professional tasks

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Own: methods for developing original software, including using modern information and intellectual technologies, to solve professional tasks	
1. Efficiency concept Functioning of markets	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**
Semester: 4			
Didactic unit: Intelligent data analysis			

1. Intelligent Data Analysis: Terms and Concepts		2	1
2. Polacchi iad		4	1
Didactic unit: Machine Training			
4. Setting the task of machine learning, species		4	1
Didactic unit: Methods and means of mead and mo			
6. Overview of methods and means of JIM and MO		4	1
7. Issues of developing the basis of knowledge of intellectual systems using methods of Jaad and Mo		6	1

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 4				
Didactic unit: Intelligent data analysis				
3. Models of the presentation of knowledge		4	1	Selection of knowledge presentation model in accordance with the task option
Didactic unit: Machine Training				
5. Methods and types of machine learning		4	1	Creating models using various methods and types of MO in accordance with the option
Didactic unit: Methods and means of mead and mo				
8. Studying the features of creating models using the H2O platform	4	6	1	Development of models using the H2O platform

Literary sources

Main literature

1. Современные методы и средства интеллектуального анализа данных : монография / [О. К. Альсова и др. ; под ред. Е. В. Рабиновича, А. А. Якименко, О. К. Альсовой] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 199 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239742

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1. Python : website. – Text : electronic / Python Software Foundation. – 2001– . – URL: https://www.python.org/ (date of the application: 24.02.2021).

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3. OSP – Гид по технологиям цифровой трансформации : [сайт]. – Текст : электронный / ООО «Издательство «Открытые системы». – 2015– . – URL: https://www.osp.ru/ (дата обращения: 24.02.2021).

4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

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3. Ганелина Н. Д. Интеллектуальные системы и технологии [Электронный ресурс] : электронный учебно-методический комплекс / Н. Д. Ганелина, М. Г. Гриф ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242694. - Загл. с экрана.

Specialized software

1 Mathcad Programming Language is an integrated programming system oriented to mathematical and engineering and technical calculations. PTC Mathcad

2 Java IDE JetBrains Intellij Idea - Java IDE
Intellij Idea

3 Modeling of electromagnetic processes MathWorks Matlab Simulink

ANNOTATION OF THE PROGRAM
Computer View Systems

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	5
2	Total hours	180
3	Total classes in the contact form, hours	66
4	Lectures, hours	36
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	10
9	Independent work, hours	114

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks	
1. OPK-2. 1 1. Know: Modern Information Engine Communication and Intelligent Technologies, Tools, Software and Technical Platforms for Solving Professional Tasks	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 3				
Didactic unit: Methods and systems of computer vision				

1. General information about light, color and vision		2	1	Lecture
2. Pre-processing methods	2	8	1	Lectures
3. Methods of segmentation of images	2	8	1	Lectures
4. Picture recognition methods	2	8	1	Lectures
5. Face Recognition		4	1	Lectures
6. Flow video processing methods		2	1	Lecture
7. Examples of computer vision systems	2	4	1	Lectures

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Methods and systems of computer vision				
1. Image filtering		4	1	Laboratory work
2. AUTOENCODER model to identify informative features of the image		4	1	Laboratory work
3. OpenCV package. Selection of image contours using the CANNY algorithm		4	1	Laboratory work
4. Face Recognition		6	1	Laboratory work

Literary sources

Main literature

1. Селянкин, В. В. Компьютерное зрение. Анализ и обработка изображений : учебное пособие / В. В. Селянкин. — Санкт-Петербург : Лань, 2019. — 152 с. — ISBN 978-5-8114-3368-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/113938 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

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5. Теория и практика цифровой обработки сигналов [Электронный ресурс] / dsplib.ru/ – Режим доступа : http://www.dsplib.ru/. – Загл. с экрана.

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Methodological support

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3. Гаврилов А. В. Системы компьютерного зрения [Электронный ресурс] : электронный учебно-методический комплекс / А. В. Гаврилов ; Новосиб. гос. техн. ун-т. - Новосибирск, [2021]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243407. - Загл. с экрана.

Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

ANNOTATION OF THE PROGRAM
Neuromorphic technologies

Course: 2, semester : 4

		Semester
№	**Kind of activity**	**4**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	43
4	Lectures, hours	20
5	Practical lessons, hours	0
6	Laboratory studies, hours	14
7	of them in an active and interactive form, hours	4
8	Consultations, hours	7
9	Independent work, hours	65

External requirements

It is capable of developing original algorithms and software, including using modern intelligent technologies, to solve professional tasks; *regarding the following learning results*:
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Know: Modern Information Ommunication and intelligent technologies, instrumental environments, software and technical platforms for solving professional tasks	
1. OPK-2. 1 1. Know: Modern Information Engine Communication and Intelligent Technologies, Tools, Software and Technical Platforms for Solving Professional Tasks	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 4				
Didactic unit: Neuromorphic technology				

1. Brain modeling		4	1	Lectures
2. Models of neural networks	4	10	1	Lectures
3. Hardware implementation of neural networks		4	1	Lectures
4. Ethics and II		2	1	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 4				
Didactic unit: Neuromorphic technology				
1. Direct distribution network		4	1	Laboratory work
2. Model of adaptive resonance theory		4	1	Laboratory work
3. Pulse neural network		6	1	Laboratory work

Literary sources

Main literature

1. Ростовцев, В. С. Искусственные нейронные сети : учебник для вузов / В. С. Ростовцев. — 2-е изд., стер. — Санкт-Петербург : Лань, 2021. — 216 с. — ISBN 978-5-8114-7462-2. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/160142 (дата обращения: 18.02.2021). — Режим доступа: для авториз. пользователей.

2. Цуриков, А. Н. Моделирование и обучение искусственных нейронных сетей : учебное пособие / А. Н. Цуриков. — Ростов-на-Дону : РГУПС, 2019. — 112 с. — ISBN 978-5-88814-867-9. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/140610 (дата обращения: 18.02.2021). — Режим доступа: для авториз. пользователей.

3. Нейронные сети в Matlab : учебное пособие / перевод с английского А. А. Маслов. — Санкт-Петербург : БГТУ 'Военмех' им. Д.Ф. Устинова, 2017. — 165 с. — ISBN 978-5-906920-72-0. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/121856 (дата обращения: 18.02.2021). — Режим доступа: для авториз. пользователей.

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2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. Забуга А. А. Теоретические основы информатики [Электронный ресурс] : учебное пособие / А. А. Забуга ; Новосиб. гос. техн. ун-т. - Новосибирск : Изд-во НГТУ, 2013. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000183874. - Загл. с экрана.

5. http://znanium.com/

Methodical support and software

Methodological support

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Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

ANNOTATION OF THE PROGRAM
Distributed information systems and databases

Course: 1 2, semester ы : 2 3

		Semester	
№	**Kind of activity**	**2**	**3**
1	Total credits	3	2
2	Total hours	108	72
3	Total classes in the contact form, hours	45	25
4	Lectures, hours	18	0
5	Practical lessons, hours	0	0
6	Laboratory studies, hours	18	18
7	of them in an active and interactive form, hours	8	0
8	Consultations, hours	7	5
9	Independent work, hours	63	47

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
owns the skills of developing a distribution divided systems and applications

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns the skills of developing a distribution divided systems and applications	
1. Mastering the development skills of distributed systems and applications	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Distributed information systems and databases				

1. The concept of a distributed information system. Advantages and disadvantages of distributed IP. Scalability. Transparency. Hardware and software builds of distributed IP.		4	1	Lecture
2. Communication in distributed systems. Remote challenge procedures. Save. Types of ties.		4	1	Lecture
3. Means of modern IP. Multitasking. Multithreading. IP Planner Insulation applications. Process synchronization mechanisms.		4	1	Lecture
4. Synchronization of time in distributed systems.		4	1	Lectures
5. Trends in distributed IP.		2	1	Lectures

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Distributed information systems and databases				
1. Development of a distributed model	2	6	1	Laboratory works
2. Apply JavaScript language to create client programs	3	6	1	Laboratory works
3. Tool software (IPS) Creating programs performed on the server side.	3	6	1	Laboratory works
Semester: 3				
Didactic unit: Distributed databases				
4. Design SQL databases		6	1	Laboratory works
5. Design NOSQL databases		6	1	Laboratory works
6. Optimization of distributed databases		6	1	Laboratory works

Literary sources

Main literature

1. Шахмаметов Р. Г. Распределенные системы искусственного интеллекта : учебное пособие : [для 4 курса дневного отделения (направление 230100 " Информатика и вычислительная техника") и заочного отделения (направления 230102 "Автоматизированные системы обработки информации и управления)] / Р. Г. Шахмаметов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 154, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000077645. - Инновационная образовательная программа НГТУ "Высокие технологии".

Additional literature

1. Васюткина И. А. Технология разработки объектно-ориентированных программ на JAVA : учебно-методическое пособие / И. А. Васюткина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2012. - 150, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000171049

Internet resources

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2. http://elibrary.nstu.ru/

3. https://e.lanbook.com/

4. http://www.iprbookshop.ru/

5. http://znanium.com/

Methodical support and software

Methodological support

1. Васюткина И. А. Учебно-методические материалы по курсам ООП и ТП [Электронный ресурс] : [учебно-методическое пособие] / И. А. Васюткина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000163978. - Загл. с экрана.

Specialized software

1 Simulation of IP Life Cycle Speed ??Specifier Software Projects and Staruml Design

2 Tools Web Development in Java Oracle Java Development Kit

3 Web Server Apache

ANNOTATION OF THE PROGRAM
Three-dimensional Graphics and Animation

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	8
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
owns methods and means of working with three-dimensional graphics

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns methods and means of working with three-dimensional graphics	
1. PC-22.V / on. 7 7. Owns methods and means of working with three-dimensional graphics	Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Geometric modeling using modifiers.				
1. Geometric modeling of objects using modifiers. .		4	1	Laboratory work

Didactic unit: Creating a Web page using the HTML language (XHTML)				
2. Construction of three-dimensional objects by the method of lofting.		4	1	Laboratory work
Didactic unit: framework Modeling.				
3. Frame modeling.	2	4	1	Laboratory work
Didactic unit: Animation.				
4. Animation.	6	6	1	Laboratory work

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Geometric modeling using modifiers.				
1. Creating geometric objects. Working with menus, toolbars and command panels, projection windows.		4	1	Practical lesson
2. Modeling geometric objects based on splines.		4	1	Practical lesson
Didactic unit: framework Modeling.				
3. Work with an editable grid. Methods for editing the increments of the mesh surface.		4	1	Practical lesson
Didactic unit: Animation.				
4. Animation tools. Animation based on key frames.		6	1	Practical lesson

Literary sources

Main literature

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Methodological support

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Specialized software

1 Package software for creating and viewing electronic publications in PDF Adobe ADOBE Acrobat format

2 Microsoft Office Application Pack

3 Operating System Microsoft Windows

ANNOTATION OF THE PROGRAM
Computer linguistics

Course: 2, semester : 4

		Semester
№	**Kind of activity**	**4**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	43
4	Lectures, hours	20
5	Practical lessons, hours	0
6	Laboratory studies, hours	14
7	of them in an active and interactive form, hours	4
8	Consultations, hours	7
9	Independent work, hours	65

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
owns design and work skills with intellectual systems

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns design and work skills with intellectual systems	
1. PC-22.V / on. 2 2. Own the skills of design and work with intelligent systems	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 4				
Didactic unit: Introduction. Main directions, tasks, methods, instrumental means of computer linguistics				
1. Introduction The main directions, concepts, tasks of computer linguistics.		1	1	lecture

2. Intelligent systems of automatic text processing. The main components and stages of their construction.		1	1	lecture
3. Morphological analysis, the construction of morphological analyzers		1	1	lecture
4. Syntactic analysis, methods for building syntactic analyzers		1	1	lecture
5. Implementation of the morphological and syntactic analyzer in search engines, examples of systems.		2	1	lecture
Didactic unit: Applied tasks for analyzing texts in intelligent systems				
6. The main tasks of automatic analysis of texts		2	1	lecture
7. Basic software (libraries and functions) of the language R to solve text analysis tasks		2	1	lecture
Didactic unit: Text Mining methods automatic processing Texts implemented in intelligent systems (classification methods)				
8. Automatic text processing methods. Cipp Law, Hips Law, TF * IDF model		2	1	lecture
9. Classification of texts based on machine learning methods with teacher		2	1	lecture
10. Evaluation of the quality classification of texts, basic measures and methods		2	1	lecture
Didactic unit: TEXT METODS MINING automatic Processing texts implemented in intelligent systems (clusterization methods)				
11. Clustering of texts based on machine learning methods without a teacher		2	1	lecture
12. Evaluation of the quality of text clustering, basic measures and methods		2	1	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 4				
Didactic unit: Applied tasks for analyzing texts in intelligent systems				
1. Frequency Text Analysis and Definition of Emotional Coloring Text in Environment R	2	8	1	laboratory work
2. Thematic modeling in the environment R	2	6	1	laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities

Semester: 4				
Didactic unit: Introduction. Main directions, tasks, methods, instrumental means of computer linguistics				
1. Main Directions and Tools Computer Linguistics		6	1	Independent study of theoretical material
Didactic unit: Applied tasks for analyzing texts in intelligent systems				
2. Main types of text analysis tasks		2	1	Independent study of theoretical material
Didactic unit: Text Mining methods automatic processing Texts implemented in intelligent systems (classification methods)				
3. Classification methods for text information processing		4	1	Independent study of theoretical material
Didactic unit: TEXT METODS MINING automatic Processing texts implemented in intelligent systems (clusterization methods)				
4. Clustering methods for text processing		4	1	Independent study of theoretical material

Literary sources

Main literature

1. Батура, Т. В. Математическая лингвистика и автоматическая обработка текстов на естественном языке : учебное пособие / Т. В. Батура. — Новосибирск : Новосибирский государственный университет, 2016. — 166 с. — ISBN 978-5-4437-0548-4. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/93489.html (дата обращения: 16.02.2021). — Режим доступа: для авторизир. пользователей

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Methodical support and software

Methodological support

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Specialized software

1 Wednesday R for statistical Calculations

2 Wednesday R-STUDIO for developing in R

3 Creating reports for laboratory work. Microsoft Microsoft Office

ANNOTATION OF THE PROGRAM
Monitoring systems and networks

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	4
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
knows methods and media TV geophysical monitoring of the environment

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
knows methods and media TV geophysical monitoring of the environment	
1. PC-22.V / on. 5 5. Knows methods and means of geophysical environmental monitoring	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 3				
Didactic unit: Geophysical monitoring				

1. Introduction Basic concepts and objectives of geoecological monitoring of the natural environment		4	1	The main concepts and objectives of the geoecological monitoring of the environment: - Spring and man-made events, -Monitoring networks and systems, -Goeecological risks -Autive and passive monitoring. Modern global and local monitoring networks and purpose systems, basic requirements, features of architecture,
2. Conjugate geophysical fields and wave processes		4	1	Conjugated geophysical fields and wave processes - their types and main characteristics
3. Setting the object of geoecological monitoring		4	1	The formulation of the task of geoecological monitoring as a reverse computational problem of geophysics. The main factors determining the accuracy of the problem of solving. Methods for solving the problem. - the notion of incorrect inverse problem; -classification of methods for solving inverse problems; -least square method; -Enging methods for finding extremes.
4. Digital data processing algorithms in geophysical monitoring tasks.	2	4	1	Digital data processing algorithms in geophysical monitoring tasks. Real-time recurrent algorithms and examples of their use. - quadrature algorithms for detecting and estimating fields of amplitudes and phases of seismicacoustic oscillations on the background of noise. Examples of application; - serial correlation algorithms for detecting and evaluating the parameters of wave forms in noise. - Algorithm of wavelet filtering and discovery of waveforms. Upgrades use.
5. Algorithms of consistent detection of changes in the properties of time series	2	2	1	Algorithms for consistent detection of changes in the properties of temporary rows in the objectives of geophysical monitoring. -autoregressive algorithms of the integrated moving average (ARPS). Application examples.

Table 3.2

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**

Semester: 3				
Didactic unit: Geophysical monitoring				
1. Familiarization and practical work with computerized stand management programs		4	1	Acquaintance and practical work with computerized booth control programs for radiation and registration of acoustic and seismic signals. The composition of the stand: digital autonomous stations (CAC) - Baikal cipher - for digital registration of acoustic and seismic signals with synchronization by GPS signals, acoustic and seismic sensors, desktop speakers, computer. A set of programs for the synthesis of different class of signals, their radiation and registration according to a given program with the subsequent visualization on the monitor screen.
2. Working with Network Management Programs Remote Computer Stand		4	1	: Acquaintance and practical work on a network level with network management programs with a remote computerized stand for radiation and registration of acoustic and seismic signals on a given program using CAC "Baikal-8" with subsequent transmission of real-time data via Wi-Fi channels in the collection center and data storage .. Stop composition: Digital stand-alone networks (Tsash) - Baikal-8 - for digital registration of acoustic and seismic signals with synchronization by GPS signals, acoustic and seismic sensors, desktop speakers, computer. A set of programs for the synthesis of different signals, their radiation and registration according to a given program with the subsequent transfer of data to the center of collecting and storing data for subsequent processing and visualization on the monitor screen

3. Working with Astra software package		4	1	Acquaintance and mastering the Astra software package, developed in the "Matlab" medium for processing acoustic and seismic signals. It is envisaged to familiarize with the methods and programs of the spectral and correlation analysis of acoustoysmic signals and noise, allocating and measuring signal parameters against the background of noise. The analysis is carried out with respect to the data accumulated in previous works No. 1,2. Acquaintance with data submission formats and reformatting programs.
4. Familiarization and practical work with posteriori algorithms and discrete optimization programs		4	1	Familiarization and practical work with posteriori algorithms and discrete optimization programs for joint detection and evaluation of wave forms in noise. The formation of model pseudo-random pulse sequences with specified identical waveforms to solve the tasks of joint detection, isolation and measurement of signal parameters against the background of noise. Acquaintance with data submission formats and reformatting programs.
5. Familiarization and practical work with a program classification of multidimensional geophysical data		2	1	Familiarization and practical work with the program of classification of multidimensional geophysical data generated by radio natural and technogenic explosions. Work is based on the use of the experimental database accumulated earlier in field experiments. Acquaintance with data submission formats and reformatting programs.

Literary sources

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Methodical support and software

Methodological support

1. Васюков В. Н. Цифровая обработка сигналов [Электронный ресурс] : электронный учебно-методический комплекс / В. Н. ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242403. - Загл. с экрана.

Specialized software

1 Package for computing in MathLab with an additional programming feature on MAPLE Mathworks Matlab Extended Symbolic Math Toolbox

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM

Standardization in the field of information technology

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	4
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
owns work skills with standards, creating documentation in the process of developing and maintaining software products

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns work skills with standards, creating documentation in the process of developing and maintaining software products	
1. PC-22.V / on. 3 3. Owns work skills with standards, creating documentation in the process of developing and maintaining software products	Lections; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 3				
Didactic unit: Standardization structure and processes in IT				

1. Standard Structure in IT		2	1	Lecture: Structure Structure in IT. International organizations and communities are standard standards bar. History and current state of the process of developing standards in the world and in Russia. Architectural Standards and Standards Development Process
2. Architectural standards.		4	1	Lecture: architectural standards. Historical aspect. Methodology of open systems. IT specification levels in open systems.
3. Overview of open system specifications		4	1	Lecture: architectural specifications of open systems. Overview. Basic specifications of open systems. Overview. Functional standardization tools. Open systems profiles.
4. IT development and documentation standards		4	1	Lecture: software development standards. Standards of the life cycle of the software product and the project. Certification and software quality assessment standards for testing standards, accompaniment and documentation
5. Professional and educational standards in IT		2	1	Lecture: Russian educational standards in the directions of "Informatics and W" and "software engineering". International recommendations for teaching software engineering. Standards professional demand in IT. Practical lesson in the form of discussion
Didactic unit: Standardization practices				
6. Historical Overview of IT Standardization Process		2	1	Lecture: Historical Overview of IT Standardization Process

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Standardization practices				
1. System Analytics and Architectural Design PS	4	6		Laboratory work: Development of functional specifications and descriptions of the architectural prototype for the selected task option.

2. Development and documentation of PS requirements in accordance with ISO / IEC / IEEE 29148		4	1	Laboratory work: registration of requirements for the software system developed in L.R.1, in the form of a document in accordance with ISO / IEC / IEEE standard 29148
3. Development of a technical assignment for the design of PS according to GOST 34.602		4	1	Laboratory work: Development of a document "Design Technical Task" for architectural and functional specifications obtained as a result of execution L.R.1.
4. Development of software documentation in accordance with GOST 19.XXX: Unified System Documentation System		4	1	Laboratory work. Development of a list and approximate content of software documentation based on PS specifications obtained as a result of execution L.R.1.

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Main literature

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Methodical support and software

Methodological support

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		Specialized software
1	Creating reports for laboratory work.	Microsoft Microsoft Office
2	Python	

ANNOTATION OF THE PROGRAM

Autonomous robots and multi-agent systems

Course: 1 2, semester ы : 2 3

		Semester	
№	**Kind of activity**	**2**	**3**
1	Total credits	2	4
2	Total hours	72	144
3	Total classes in the contact form, hours	42	47
4	Lectures, hours	18	0
5	Practical lessons, hours	0	18
6	Laboratory studies, hours	18	18
7	of them in an active and interactive form, hours	4	4
8	Consultations, hours	4	9
9	Independent work, hours	30	97

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
Owns design and working skills with multi-agent systems and mobile robots

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Owns design and working skills with multi-agent systems and mobile robots	
1. Models, properties and methods for describing information systems	Lections; Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Overview of the current state of robotics				

1. Review of the current state of robotics. Examples and features of solving various tasks using autonomous robots		2	1	
Didactic unit: generalized structural-functional model of an autonomous robot				
2. Generalized structural and functional model of an autonomous robot. Examples of existing developments used in various types of human activities.		4	1	
Didactic unit: Issue of supply and energy conversion for ETS				
3. Algorithms, models and methods for managing robotic complexes		4	1	
Didactic unit: Methods and models of controlling the behavior of autonomous robots				
4. Methods and models of managing the behavior of autonomous robots		4	1	
Didactic unit: Examples of using autonomous robots				
5. Examples of using autonomous robots	4	4	1	Work at the lecture. Student reports on examples of practical application of RTS and complexes

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Examples of using autonomous robots				
6. Study of typical control algorithms Autonomous mobile robot		18	1	Study of typical control algorithms Autonomous mobile robot
Semester: 3				
Didactic unit: Theory of graphs				
7. Studying the possibilities of developing a multi-agent system model to solve a specific practical task in Netlogo 5.2		18	1	Studying the possibilities of developing a multi-agent system model to solve a specific practical task in NetLogo 5.2 in accordance with the option

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Theory of graphs				
8. Concept of agent in multi-agent system		2	1	Discussion on pre-presented material
9. Architecture of multi-agent systems	4	8	1	Discussion of materials selected by students about various architectures of Mas

10. Methods and means of managing agents in multi-agent systems on the example of existing standards and systems		8	1	Student reports

Literary sources

Main literature

1. Сырецкий Г. А. Проектирование автоматизированных систем. Ч. 1 : учебное пособие / Г. А. Сырецкий ; Новосиб. гос. техн. ун-т. - Новосибирск, 2014. - 154, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000202725

2. Шахмаметов Р. Г. Распределенные системы искусственного интеллекта : учебное пособие : [для 4 курса дневного отделения (направление 230100 " Информатика и вычислительная техника") и заочного отделения (направления 230102 "Автоматизированные системы обработки информации и управления)] / Р. Г. Шахмаметов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 154, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000077645. - Инновационная образовательная программа НГТУ "Высокие технологии".

Internet resources

1. Python : website. – Text : electronic / Python Software Foundation. – 2001– . – URL: https://www.python.org/ (date of the application: 24.02.2021).

2. http://elibrary.nstu.ru/

3. NetLogo : [website]. – Text : electronic / Center for Connected Learning and Computer-Based Modeling. – 1999– . – URL: https://ccl.northwestern.edu/netlogo/ (date of the application: 24.02.2021).

4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

1. Долозов Н. Л. Компьютерные сети : учебно-методическое пособие / Н. Л. Долозов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2013. - 110, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000185242

2. Швайкова И. Н. Системы искусственного интеллекта [Электронный ресурс] : электронный учебно-методический комплекс / И. Н. Швайкова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000156351. - Загл. с экрана.

3. Першина Ж. С. Робототехнические системы и комплексы [Электронный ресурс] : электронный учебно-методический комплекс / Ж. С. Першина, А. Б. Колкер ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222650. - Загл. с экрана.

4. Дубков И. С. Решение практических задач на базе технологии интернета вещей : [учебное пособие] / И. С. Дубков, П. С. Сташевский, И. Н. Яковина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 79 с. : ил.. табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls0002341898

Specialized software

1 Wednesday graphic programming means of automating NI LabVIEW

2 Mathcad Programming Language is an integrated programming system oriented to mathematical and engineering and technical calculations. PTC Mathcad

ANNOTATION OF THE PROGRAM

Project management, engineering and reengineering information systems

Course: 1 2, semester ы : 2 3

		Semester	
№	**Kind of activity**	**2**	**3**
1	Total credits	2	4
2	Total hours	72	144
3	Total classes in the contact form, hours	42	47
4	Lectures, hours	18	0
5	Practical lessons, hours	0	18
6	Laboratory studies, hours	18	18
7	of them in an active and interactive form, hours	0	8
8	Consultations, hours	4	9
9	Independent work, hours	30	97

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
owns work skills with standards, creating documentation in the process of developing and maintaining software products

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns work skills with standards, creating documentation in the process of developing and maintaining software products	
1. PC-22.V / on. 3 3. Owns work skills with standards, creating documentation in the process of developing and maintaining software products	Lections; Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				

Didactic unit: Phonetics. **Grammar.** **Vocabulary.** **Audition.** **Speaking.** **Reading.** **Letter.** **Culture and traditions of the countries studied.** **Rules of speech etiquette.**				
1. Management of the program project at different phases of the life cycle		2	1	Features of program projects. The role and place of the UPP in software engineering (PI). The components of organizational (management) and technological (execution) planning in the UPP. Standardization in the UPP. Standard ISO 12207. Sweep knowledge about SWEBOK software engineering. Sections "Management in PI and" Processes in PI "
2. Features of project management in flexible methodologies		2	1	System of work planning in SCRUM, BCLOG project and sprint backot. The activities of the project owner. Creating and evaluation of "User Stories" (User Story). Assessment of labor intensity setting. Poker planning. Project Metric in Scrum. Sprint combustion diagram. Business game: Collective assessment of the complexity of the assigned job by the poker planning method.
3. Project Risk Assessment. Forming and Planning Team		2	1	Definition and characteristics of risk. Scares for estimating consequences and probability. Identification methods. Risk response. The most likely risks on boam and archipelane. Qualitative risk assessments. Quantitative estimates: sensitivity analysis, solutions tree, imitation modeling. Management aimed at reducing risks.

4. Estimation of the cost and timing of the project		2	1	Probabilistic nature of estimation, its nature. The consequences of "aggressive" planning. Initial data for evaluation, project characteristics used in assessment. Evaluation of the timing on the basis of labor intensity (on boam). Evaluation based on your own experience. PERT method. Evaluation based on functional points. Evaluation by industry data. Method COCOMO II.
Didactic unit: Project Management				
5. Project management as engineering discipline		2	1	The essence and structure of project activity and project management.
6. PMBOK project management knowledge		4	1	Project management standards. PMBOK knowledge arch. Structure and content
Didactic unit: Engineering and reengineering IP				
7. Business Process Reengineering		2	1	The role and content of business analytics in the project and in the program project. Modeling business processes and subject area. Business processes reengineering in connection with the introduction of IT technologies.
9. Reengineering information systems		2	1	Types and technologies of reengineering

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Phonetics. **Grammar.** **Vocabulary.** **Audition.** **Speaking.** **Reading.** **Letter.** **Culture and traditions of the countries studied.** **Rules of speech etiquette.**				
1. Collective project. Discussion.		4	1	Informal presentation by the teacher of the essence of the project (vision): subject area, glossary, functionality, borders. Elections of team leader, division into brigades, distribution of functional modules

2. Collective project. Development of project frame		4	1	Preparation by the teacher and the project frame leader: abstraction, interfaces and workpieces of classes - key and used together with several teams. Survey of the carcass along with all project participants. Registration in the version control system
3. Collective project. Development of architectural prototype		4	1	Implementation of the main components of the architectural prototype: DB, ORM, business layer, Communication classes, architectural classes.
3. Collective project. Design, Programming, Debugging and Testing Modules		4	1	Awtonial development and testing by brigade modules, the creation of test object plugs, replacing them to object objects developed by other brigades. If necessary, correction and approval of interfaces in the framework. Maintaining a common branch in the version control system. Test implementation of a separate scenario.
5. Collective project. Discussion of the results of iteration.		2	1	Demonstration of the project. Discussion of the results of iteration. Formation of statistics (metric) project on the results of iteration ..
Semester: 3				
Didactic unit: Management of software projects_				
6. Collective project. Iteration planning.		4	1	Development of a package of agreed project documents (Baseline) -
7. Collective project. Functional filling of the project		4	1	Adding a functional by adding tasks to the project prototype (server and client components)
8. Collective project. Project Integration		4	1	Sequential reduction of project parts, integration testing, minimizing project into a prototype.
9. Collective project. Project delivery		4	1	Development of acceptance tests. Demonstration and discussion of the project. Paperwork. Overview of the project metric
10. Collective project. The discussion of the results.		2	1	The final design of the project results and the final documents

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				

Didactic unit: Management of software projects_				
1. Project risk assessment.	2	2		The discussion of the "rear number" risks of a collective project. Qualitative risk assessment. Development plan countering risks
2. Estimation of the cost and timing of the project.	2	2		Application of methods for assessing the cost and timing of the project based on the results of the first iteration.
3. Estimation of the complexity of project tasks.	2	2		Evaluation of the complexity of tasks in the project. Mastering the Poker Planning Poker Planning Practice on the example of the tasks of the past and current item.
4. Iteration planning.	2	2		Studying the practice of current planning and system analytics in SCRUM.
Didactic unit: Engineering and reengineering IP_				
5. Reengineering business processes. Analysis and modeling of business processes in BPMN notation		2	1	Reenginirring business processes at the study stage. Business Process Modeling: Functional Charts, UML, BPMN. Study of the Aris Express software package
6. Reengineering information systems		2	1	Support of information systems. Database reengineering,
7. Reenginirring software systems.		2	1	Refactoring and reengineering. Reenginiring databases, business logic, architecture. Escort. Configuration management
8. Engineering information systems		2	1	Types of information systems. Stages and engineering content.
9. Engineering information systems.		2	1	Analysis of examples of engineering information systems of various applications

Literary sources

Main literature

1. Преображенская Т. В. Управление проектами : [учебное пособие] / Т. В. Преображенская, М. Ш. Муртазина, А. А. Алетдинова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 121, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238156

2. Муртазина М. Ш. Управление проектами в сфере информационных технологий [Электронный ресурс] : М. Ш. Муртазина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243323. - Загл. с экрана.

Internet resources

1. Архипенков С. Лекции по управлению программными проектами [Электронный ресурс] / С. Архипенков. – Москва, 2009. — 128 с. – Режим доступа : http://www.arkhipenkov.ru/resources/sw_project_management.pdf. – Загл. с экрана.

2. http://elibrary.nstu.ru/

3. Все об управлении проектами : [Электронный ресурс] : планирование и контроль над проектами с OMNITRACKER. - Режим доступа: http//www.pmphelp.net. - Загл. с экрана.

4. https://e.lanbook.com/

5. Онлайн системы по управлению проектами [Электронный ресурс]. - Режим доступа: http://www.onlineprojects.ru. - Загл. с экрана.

6. http://www.iprbookshop.ru/

7. http://znanium.com/

Methodical support and software

Methodological support

1. Пустовалова Н. В. Программная инженерия (метрическая теория программ) [Электронный ресурс] : электронный учебно-методический комплекс [для студентов направления 080800 Прикладная информатика] / Н. В. Пустовалова, Г. И. Кайгородцев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2014]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000208496. - Загл. с экрана.

2. Преображенская Т. В. Управление проектами [Электронный ресурс] : электронный учебно-методический комплекс / / Т. В. Преображенская ; Новосиб. гос. техн. ун-т. - Новосибирск, [2016]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000226586. - Загл. с экрана.

3. Романов Е. Л. Программная инженерия [Электронный ресурс] : электронный учебно-методический комплекс / Е. Л. Романов ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000220170. - Загл. с экрана.

Specialized software

1 Wednesday to solve statistical tasks Statistica StatSoft Statistica

2 Multifunctional System Megaputer Polyanalyst Data Analysis

3 Java IDE JetBrains Intellij Idea - Java IDE
Intellij Idea

4 Python

ANNOTATION OF THE PROGRAM
Inductive Data Analysis

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	2
2	Total hours	72
3	Total classes in the contact form, hours	33
4	Lectures, hours	8
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	5
9	Independent work, hours	39

External requirements

is able to independently acquire, develop and apply mathematical, natural scientific, socio-economic and professional knowledge to solve non-standard tasks, including in a new or unfamiliar environment and in the interdisciplinary context; *regarding the following learning results*:
to know: mathematical, natural science and Socio-economic methods for use in professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
to know: mathematical, natural science and Socio-economic methods for use in professional activities	
1. OPK-1. 1 1. Know: Mathematical, natural science and socio-economic methods for use in professional activities	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 3				
Didactic unit: Thematic catalogs and scientific and technical journals				

1. The main definitions and concepts of INN. Inductive approach, methods and algorithms for processing and analyzing signals, data and knowledge.		2	1	lecture
Didactic unit: Main types of modern and promotional automatic devices and control systems in normal and emergency power systems				
2. Soft methods and algorithms for processing and analyzing data, solving applied tasks.		4	1	lecture
Didactic unit: Basic methods and qualimetry approaches Models				
3. Elements of qualimetry of models, quality of modeling results, quality management.		2	1	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Thematic catalogs and scientific and technical journals				
1. Data types. Approaches to data analysis (deductive, inductive). The basic concepts of the theory of algorithms. Classes of algorithms and challenges in complexity.		2	1	practice
Didactic unit: Main types of modern and promotional automatic devices and control systems in normal and emergency power systems				
2. Methods and algorithms for processing and analyzing data, solutions of applied problems (neural networks, genetic, rose and immune, multi-agent, cognitive, visual modeling, undetermined computing).		10	1	practice
Didactic unit: Basic methods and qualimetry approaches Models				
3. Methods of qualimetry models, assessment and management of the quality of modeling results (research) of objects and data analysis.		6	1	practice

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Thematic catalogs and scientific and technical journals				

1. The main concepts and features of the inductive approach to modeling (research) of objects and data analysis; models self-proposal; Half methods and algorithms, the automation of ordering and selecting models under solved task; Intelligent and exploration analysis (study) of data.		4	1	Independent study
Didactic unit: Main types of modern and promotional automatic devices and control systems in normal and emergency power systems				
2. Methods and algorithms for processing and analyzing data (neural networks, genetic, rose and immune, multi-agent, cognitive, visual modeling, undetermined computing).		4	1	Independent study
Didactic unit: Basic methods and qualimetry approaches Models				
3. The main tasks and methods of qualimetry models.		4	1	Independent study

Literary sources

Main literature

1. Губарев В. В. Введение в теоретическую информатику. Ч. 2 : учебное пособие / В. В. Губарев; Новосиб. гос. техн. ун-т. - Новосибирск, 2015. - 471, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222658

2. Губарев В. В. Введение в облачные вычисления и технологии : учебное пособие / В. В. Губарев, С. А. Савульчик, Н. А. Чистяков ; Новосиб. гос. техн. ун-т. - Новосибирск, 2013. - 44, [3] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000180775

Internet resources

1. Национальное общество имитационного моделирования [Электронный ресурс]. - НП "НОИМ", 2012-2017. - Режим доступа: http://simulation.su/ru.html. - Загл. с экрана.

2. http://elibrary.nstu.ru/

3. Современная цифровая образовательная среда в РФ : сайт / Министерство науки и высшего образования РФ. – 2017– . – URL: https://test.online.edu.ru/public/promo.xhtml (дата обращения: 15.02.2021). – Режим доступа: для зарегистрир. пользователей. – Текст : электронный.

4. https://e.lanbook.com/

5. The R Project for Statistical Computing : website. – 2021. – URL: https://www.r-project.org/ (date of the application: 12.02.2021). – Text: electronic.

6. StatSoft: Statistica [Электронный ресурс]. – Режим доступа: http://statsoft.ru. – Загл. с экрана.

7. StatSoft [Электронный ресурс] : электрон. учеб.по статистике. – Режим доступа: http://www.statsoft.ru/home/textbook/default.htm. - Загл. с экрана.

8. http://www.iprbookshop.ru/

9. http://znanium.com/

Methodical support and software

Methodological support

1. Губарев В. В. Введение в теоретическую информатику. Ч. 1 : учебное пособие / В. В. Губарев ; Новосиб. гос. техн. ун-т. - Новосибирск, 2014. - 418, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000203069

2. Губарев В. В. Квалификационные исследовательские работы : учебное пособие / В. В. Губарев, О. В. Казанская ; Новосиб. гос. техн. ун-т. - Новосибирск, 2014. - 78, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000203794

Specialized software

1 Modeling of electromagnetic processes MathWorks Matlab Simulink

2 Microsoft Office Application Pack

3 Operating System Microsoft Windows

4 Java Oracle NetBeans IDE Developmental Development Wednesday

5 Wednesday R-STUDIO for developing in R

6 Wednesday R for statistical Calculations

ANNOTATION OF THE PROGRAM
Artificial neural networks

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	2
2	Total hours	72
3	Total classes in the contact form, hours	33
4	Lectures, hours	8
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	5
9	Independent work, hours	39

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; ***regarding the following learning results*****:**
owns design and work skills with intellectual systems

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
owns design and work skills with intellectual systems	
1. PC-22.V / on. 2 2. Own the skills of design and work with intelligent systems	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Artificial neural networks				
1. Basics of neurocomputer		2	1	Lecture

2. Direct distribution network		2	1	Lecture
3. Recurrent neural networks		2	1	Lecture
4. Deep learning		2	1	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Artificial neural networks				
1. Method of learning NA inverse error distribution		4	1	Practice
2. Hopfield model		4	1	Practice
3. Model of adaptive resonance theory		4	1	Practice
4. Autoanks		6	1	Practice

Literary sources

Main literature

1. Ростовцев, В. С. Искусственные нейронные сети : учебник для вузов / В. С. Ростовцев. — 2-е изд., стер. — Санкт-Петербург : Лань, 2021. — 216 с. — ISBN 978-5-8114-7462-2. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/160142 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

2. Соробин, А. Б. Сверточные нейронные сети: примеры реализаций : учебно-методическое пособие / А. Б. Соробин. — Москва : РТУ МИРЭА, 2020. — 159 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/163853 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

3. Нейронные сети в Matlab : учебное пособие / перевод с английского А. А. Маслов. — Санкт-Петербург : БГТУ 'Военмех' им. Д.Ф. Устинова, 2017. — 165 с. — ISBN 978-5-906920-72-0. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/121856 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. Забуга А. А. Теоретические основы информатики [Электронный ресурс] : учебное пособие / А. А. Забуга ; Новосиб. гос. техн. ун-т. - Новосибирск : Изд-во НГТУ, 2013. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000183874. - Загл. с экрана.

5. http://znanium.com/

Methodical support and software

Methodological support

1. Гаврилов А. В. Нейронные сети и нейронные компьютеры [Электронный ресурс] : электронный учебно-методический комплекс / А. В. Гаврилов ; Новосиб. гос. техн. ун-т. - Новосибирск, [2021]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243408. - Загл. с экрана.

2. Системы искусственного интеллекта : методические указания для заочной формы обучения АВТФ / Новосиб. гос. техн. ун-т ; [сост.: А. В. Гаврилов]. - Новосибирск, 2004. - 73 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000042311

Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM

Cyberphysical systems: theory and applications

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	79
4	Lectures, hours	36
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	5
9	Independent work, hours	29

External requirements

are able to carry out professional activities in the development and use of specialized hardware and software; *regarding the following learning results*:
Owns the skills of the development and use of hybrid and cyberphysical systems

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
Owns the skills of the development and use of hybrid and cyberphysical systems	
1. acquaintance with the general concept and principles of constructing cyber-physical systems (CFS) as a new technological platform for the formation of a universal information and management environment that combines key trends in the development of through information and information and applied technologies, and intended To solve a wide class of industrial automation and management tasks	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 1				
Didactic unit: Hierarchical network control structures. Self-organizing and self-dedicated systems				

1. Introduction	4	4	1	The general definition of KPS as a technological platform for the integration of promising information technologies and the relevance of its formation to solve a large group of applied tasks is noted. It shows the relevance and efficiency of using such systems for industrial automation and production and production management tasks, especially when controlling hazardous technological processes and complexes in the conditions of the influence of a large number of external and internal factors. It is noted that the development and implementation of modern CFS requires the study of a fundamental scientific base based on various branches of engineering, mathematics, computer science and specific knowledge of the subject area.
2. General Concept of the theory of the formation of the CFS	8	8	1	The overall concept of the theory of CFS formation as a "deeply integrated" technological platform, uniting the group of "breakthrough" technologies - intellectualization, hierarchical network organization, self-study and development, the synergistic effect of the unification of which gives the management systems new functionality in solving a wide class of applied tasks, and In particular, the tasks of control are poorly formalized objects, processes, phenomena. To this end, key trends in the formation of end-to-end information and communication and information and control technologies that are constituted elements of hybrid technological platforms are analyzed. A group of basic trends that determine the ability of KFS to interact with the physical world and expand its capabilities through computing, communications and management, which is a key factor for future technological developments.

4. Synergetic integration. Basic concepts and essence of synergistic integration.	8	8	1	The overall concept of the theory of CFS formation as a "deeply integrated" technological platform, uniting the group of "breakthrough" technologies - intellectualization, hierarchical network organization, self-study and development, the synergistic effect of the unification of which gives the management systems new functionality in solving a wide class of applied tasks, and In particular, the tasks of control are poorly formalized objects, processes, phenomena. To this end, key trends in the formation of end-to-end information and communication and information and control technologies that are constituted elements of hybrid technological platforms are analyzed. A group of basic trends that determine the ability of KFS to interact with the physical world and expand its capabilities through computing, communications and management, which is a key factor for future technological developments.

6. Technological platform - as a way to implement the concept of KFS. Platform structure	8	8	1	The overall concept of the theory of CFS formation as a "deeply integrated" technological platform, uniting the group of "breakthrough" technologies - intellectualization, hierarchical network organization, self-study and development, the synergistic effect of the unification of which gives the management systems new functionality in solving a wide class of applied tasks, and In particular, the tasks of control are poorly formalized objects, processes, phenomena. To this end, key trends in the formation of end-to-end information and communication and information and control technologies that are constituted elements of hybrid technological platforms are analyzed. A group of basic trends that determine the ability of KFS to interact with the physical world and expand its capabilities through computing, communications and management, which is a key factor for future technological developments.
7. CFS intellectualization	8	8	1	Methods, models, mechanisms of self-organization of KFS are considered as complex multi-agent management systems and distributed information management systems, with cognitive features of extracting, accumulation and application of knowledge for the adoption of effective management solutions.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Hierarchical network control structures. Self-organizing and self-dedicated systems				

3. Existing approaches and definition of KFS	8	8	1	The overall concept of the theory of CFS formation as a "deeply integrated" technological platform, uniting the group of "breakthrough" technologies - intellectualization, hierarchical network organization, self-study and development, the synergistic effect of the unification of which gives the management systems new functionality in solving a wide class of applied tasks, and In particular, the tasks of control are poorly formalized objects, processes, phenomena. To this end, key trends in the formation of end-to-end information and communication and information and control technologies that are constituted elements of hybrid technological platforms are analyzed. A group of basic trends that determine the ability of KFS to interact with the physical world and expand its capabilities through computing, communications and management, which is a key factor for future technological developments.

5. System approach to the development of KFS. Breakdown technology CFS concept.	8	8	1	The overall concept of the theory of CFS formation as a "deeply integrated" technological platform, uniting the group of "breakthrough" technologies - intellectualization, hierarchical network organization, self-study and development, the synergistic effect of the unification of which gives the management systems new functionality in solving a wide class of applied tasks, and In particular, the tasks of control are poorly formalized objects, processes, phenomena. To this end, key trends in the formation of end-to-end information and communication and information and control technologies that are constituted elements of hybrid technological platforms are analyzed. A group of basic trends that determine the ability of KFS to interact with the physical world and expand its capabilities through computing, communications and management, which is a key factor for future technological developments.
8. Using knowledge to control under uncertainty	8	8	1	Methods, models, mechanisms of self-organization of KFS are considered as complex multi-agent management systems and distributed information management systems, with cognitive features of extracting, accumulation and application of knowledge for the adoption of effective management solutions.
9. Neural networks. Training ability.	12	12	1	Methods, models, mechanisms of self-organization of KFS are considered as complex multi-agent management systems and distributed information management systems, with cognitive features of extracting, accumulation and application of knowledge for the adoption of effective management solutions.

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Methodical support and software

Methodological support

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Specialized software

1 on 3-dimensional modeling and animation Autodesc 3DS MAX

2 Mathcad Programming Language is an integrated programming system oriented to mathematical and engineering and technical calculations. PTC Mathcad