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«12» December 2024 Protocol of the EMC № 3 «28» February 2025 Protocol of the AC № 10

EDUCATIONAL PROGRAM

7M06101 «Software Engineering»

Code and classification of the field of education: 7M06 Information and Communication Technology

Code and classification of training area: 7M061 Information and Communication Technology

Group of educational programs: M094 Information Technology

ISCED level: 7

NQR level: 7

ORC level: 7

Academic degree awarded Master of Technical Sciences in the educational program "7M06110 Software Engineering"

Duration of study: 2 years

Number of credits: 120

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Director of
«KnewIT Programming School» LLC

Bekaulov N.M.

«__» ____ 2025

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Director of «ITCBOOTCAMP» LLC

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Almaty, 2025

The code and name of the educational program: 7M06101 Software Engineering

№	Educational program developers (Position, scientific degree, academic degree, Full name)	Signature
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List of abbreviations and acronyms

BD	Cycle of basic disciplines
BC	Basic competency
BM	Basic module
UC	University component
HE	Higher education
NMS	National Mandatory Standards of Higher and Post-Graduate Education
ATT	Additional types of training
EQF	European qualifications framework
EFE	European foundation for education
KSA	Knowledge, Skills and Abilities
FA	Final attestation
EC	Elective component
ISCED	International Standard Classification of Education
NQF	National qualifications framework
NQS	National qualifications system
GHM	General humanitarian module
RC	Required component
GEM	General education module
GED	Cycle of general education disciplines
EP	Educational program
GPM	General professional module
SQF	Sectoral qualifications framework
GEC	General education competency
MD	Cycle of major disciplines
PI	Professional internship
PS	Professional standard
PE	Postgraduate education
PC	Professional competency
PM	Professional module
LO	Learning outcome
QMS	Quality Management System

1. Description of the educational program

The educational program 7M06101 «Software Engineering» is designed to implement the principles of democratic education management, expanding the boundaries of academic freedom and the powers of educational institutions, which will ensure the adaptation of the system of technical and vocational education to the changing needs of society, the economy of the labor market. The flexibility of the program will take into account the abilities and needs of the individual, production and society.

The educational program is developed taking into account the needs of the labor market in the field of information and communication technologies. This educational program ensures the application of an individual approach to students, ensures the transformation of professional competencies from professional and qualification standards into learning outcomes. Student-centered learning is provided. This principle of education implies a shift in emphasis in the educational process from teaching to learning.

The fields of professional activities of graduates are higher educational institutions, research institutions, production of software development for information and computing systems for various purposes, software companies, IT departments of industrial enterprises, design organizations, public and private enterprises and organizations that develop, implement and use computer hardware and software in various fields, in other words almost all spheres of human activity.

2. Aim and objectives of the educational program

The purpose of the EP - is to train researchers in the field of software engineering, managers in the field of software development, highly qualified developers of software and information systems and architects of software systems for the IT industry of the Republic of Kazakhstan.

AP objectives:

1. To train researchers in the field of software development.
2. To teach the conduct of scientific research related to the objects of professional activity, and the analysis of existing concepts, theories and approaches to the development of programs and the creation of corporate information systems.
3. To develop the ability of graduate students to develop new and improve existing methods and algorithms for data processing in information and computer systems.
4. To teach graduate students to apply the obtained theoretical and practical knowledge in solving practical problems in the field of ICT, to successfully carry out managerial and research activities.
5. To instill in graduate students the skills to independently, constantly acquire, develop and apply professional knowledge, skills and abilities to solve non-standard tasks.
6. To teach graduate students to apply the knowledge of pedagogy and psychology of higher education in their teaching activities, as well as apply interactive teaching methods.
7. Familiarize undergraduates with conducting system analysis to solve complex technical problems and applying the analysis results to optimize the software development process to the greatest extent possible.
8. Teach undergraduates to optimize the software development process.
9. To teach a generalization of the results of research and analytical work in the form of a dissertation, a scientific article and reports at scientific and technical conferences, a report, an analytical note, etc.

3. Passport of the academic program

№	Name	Description
1.	Education area code and classification	7M06 Information and Communication Technology
2.	Training direction code and classification	7M061 Information and Communication Technology

3.	Group of academic programs	M094 Information Technology
4.	Name of the educational program	Software Engineering»
5.	Aim of the educational program	Training of researchers in the field of software engineering, managers in the field of software development, highly qualified developers of software and information systems and architects of software systems for the IT industry of the Republic of Kazakhstan
6.	Type of the educational program	New EP
7.	Level according to the National Classifications Framework	7th level
8.	Level according to the Sectoral Qualifications Framework	7th level
9.	Distinctive features of the program	No
10.	Partner University	
11.	Academic degree awarded	Master of Technical Sciences in the educational program "7M06110 Software Engineering"
12.	Duration of study	2 years
13.	Volume of credits	120 ECTS credits
14.	Language of education	English
15.	Atlas of new professions	Blockchain-technologist, Devops engineer, Developer universal ai, Product-manager
16.	Regional standard	Not provided
17.	Availability of an attachment to the training license	Available
18.	License number for the training area	KZ81LAM00001263
19.	Availability of program accreditation	ASIIN
20.	Generated learning outcomes	LO1: Formulate and solve problems arising in the course of research activities that require in-depth professional knowledge. LO2: Select the necessary approaches and research methods, modify existing ones and develop new ones, based on the objectives of a particular study, as well as to solve problems in a new environment, in a broader interdisciplinary context. LO3: Apply methodological and methodological knowledge in the conduct of scientific research, pedagogical and educational work. LO4: Apply psychological methods and means of improving the effectiveness and quality of education in the learning process. LO5: Apply quantitative methods and techniques to develop effective solutions to manufacturing problems while taking into account social, ethical, and scientific considerations. LO6: Analyze software within the scope of production activities. LO7: Design and develop software systems to solve applied problems within the framework of production activities. LO8: Manage a team in the software development process.

		LO9: Use advanced technologies to organize effective data storage and management; apply data analysis methods to solve various problems. LO10: Know the methods of scientific research and academic writing, understand the importance of the principles and culture of academic integrity; be able to communicate information, ideas, and conclusions clearly and unambiguously to both specialists and non-specialists. LO11: Demonstrate the ability to apply modern psychological and pedagogical strategies in managing the educational environment of the university, designing curricula, implementing inclusive and digital approaches, as well as in professional interaction and development of academic teams based on the principles of leadership, coaching and scientific analysis.

4. Professional Standards (PS), profession cards, labor functions

№	Name of the PS	Profession card	Labor functions
1	Development of artificial intelligence applications	"Artificial Intelligence Specialist"	1. Organization of expert system development processes 2. Management of expert system development processes
		"Artificial Intelligence Engineer"	1. Implementation of artificial intelligence systems 2. Experimental operation of artificial intelligence systems and its implementation
2	Professional standard: for teachers (teaching staff) of higher and (or) postgraduate education institutions	"Teacher, assistant in the field of education, EPVO "	Conducting scientific research
		"Teacher, Senior Lecturer/Senior Lecturer in Education, EPVO "	1. Education 2. Implementation of scientific and methodological work
3	Software testing	"QA - Engineer"	1. Implementing a quality management system in accordance with internal and external standards and the culture of the organization. 2. Maintaining external certification in accordance with quality standards, and tracking statistics to predict quality results.
		"Software Engineer"	1. Algorithm creation and flowchart creation based on software specification 2. Code writing and software program development
4	Development of IoT systems	"IoT Systems Software Engineer"	1. Ensuring interaction and management of IoT devices 2. Improving and implementing the procedure for monitoring the performance of the IoT system
5	Cloud Technologies Developments	"Cloud Developer"	1. Cloud systems software management and development
		"Cloud Computing Specialist"	1. Technical support for the processes of creation (modification) and maintenance of integration solutions for cloud services

			2. Carrying out work on the creation (modification) and maintenance of integration solutions for cloud services
6	Development of systems for processing and storing big data	"Computer Vision Programmer"	1. Data preparation and software development for video and graphic image processing 2. Application and computer vision hardware management
		"Data Mining Specialist"	1. Development and management of software tools for automating big data processing
		"Machine Learning Specialist"	1. Design and implementation of systems using machine learning
		"Neural Network Specialist"	1. Application of neural networks in solving complex problems in data processing

5. List of the EP competencies

BC1: Ability to use acquired knowledge for the original development and application of ideas in the context of scientific research.

BC2: Ability to apply acquired knowledge in professional activities to solve industrial (production-related) tasks.

BC3: Ability to independently and continuously acquire, develop, and apply professional knowledge, skills, and abilities.

BC4: Ability to apply knowledge of pedagogy and higher education psychology in teaching activities.

BC5: Ability to summarize the results of scientific research and analytical work in the form of a thesis, scientific article, report at scientific and technical conferences, report, analytical note, etc.

PC1: Ability to select and develop methods for analyzing objects of professional activity based on general trends in ICT development.

PC2: Ability to perform analysis to solve complex software (technical) problems and ensure the implementation of the most optimal solutions.

PC3: Ability to apply advanced technologies for software development within the professional field, as well as to manage the development process.

PC4: Ability to improve software products to enhance their competitiveness and efficiency at all stages of the life cycle.

6. List of learning outcomes of the EP

LO1: Formulate and solve problems that arise during research activities and require in-depth professional knowledge.

LO2: Select the necessary approaches and research methods, modify existing ones and develop new ones, based on the objectives of a particular study, as well as to solve problems in a new environment, in a broader interdisciplinary context.

LO3: Apply methodological and methodological knowledge in the process of conducting scientific research, pedagogical and educational work. Demonstrate the skills necessary to continue learning independently.

LO4: Apply psychological methods and means of increasing the effectiveness and quality of teaching in teaching activities.

LO5: Apply quantitative methods and techniques to develop effective solutions to manufacturing problems while taking into account social, ethical, and scientific considerations.

LO6: Analyze software within the scope of production activities.

LO7: Design and develop software systems to solve applied problems within the framework of production activities.

LO8: Manage a team in the software development process.

LO9: Use advanced technologies to organize effective data storage and management; apply data analysis methods to solve various problems.

LO10: Know the methods of scientific research and academic writing, understand the importance of the principles and culture of academic integrity; be able to communicate information, ideas, and conclusions clearly and unambiguously to both specialists and non-specialists.

LO11: Demonstrate the ability to apply modern psychological and pedagogical strategies in managing the educational environment of the university, designing curricula, implementing inclusive and digital approaches, as well as in professional interaction and development of academic teams based on the principles of leadership, coaching and scientific analysis.

7. Matrix for correlating the learning outcomes of the EP with the formed competencies (V)

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11
BC1	V				V		V			V	
BC2	V					V	V			V	
BC3	V		V	V						V	
BC4				V							
BC5		V					V				V
PC1		V				V			V		V
PC2		V					V	V	V		
PC3								V			
PC4	V					V		V	V		

8. The relationship of LO with labor functions

№	LO	Labor functions
1.	LO1: Formulate and solve problems that arise during research activities and require in-depth professional knowledge.	Writing code and developing software for software
2.	LO2: Select the necessary approaches and research methods, modify existing ones and develop new ones, based on the objectives of a particular study, as well as to solve problems in a new environment, in a broader interdisciplinary context.	Algorithm creation and flowchart creation based on software specification
3.	LO3: Apply methodological and methodological knowledge in the process of conducting scientific research, pedagogical and educational work. Demonstrate the skills necessary to continue learning independently.	Application of the quality management system in accordance with internal and external standards and the culture of the organization.
4.	LO4: Apply psychological methods and means of increasing the effectiveness and quality of teaching in teaching activities.	Application of the quality management system in accordance with internal and external standards and the culture of the organization.
5.	LO5: Apply quantitative methods and techniques to develop effective solutions to manufacturing problems while taking into	Application of the quality management system in accordance with internal and external standards and the culture of the organization.

	account social, ethical, and scientific considerations.	
6.	LO6: Analyze software within the scope of production activities.	Guidance of expert systems development processes
7.	LO7: Design and develop software systems to solve applied problems within the framework of production activities.	Development and management of software tools for automation of big data processing
8.	LO8: Manage a team in the software development process.	Cloud Systems Software Management and Development
9.	LO9: Use advanced technologies to organize effective data storage and management; apply data analysis methods to solve various problems.	Development and management of software tools for automation of big data processing
10.	LO10: Know the methods of scientific research and academic writing, understand the importance of the principles and culture of academic integrity; be able to communicate information, ideas, and conclusions clearly and unambiguously to both specialists and non-specialists.	Conducting scientific research
11.	LO11: Demonstrate the ability to apply modern psychological and pedagogical strategies in managing the educational environment of the university, designing curricula, implementing inclusive and digital approaches, as well as in professional interaction and development of academic teams based on the principles of leadership, coaching and scientific analysis.	Education Implementation of scientific and methodological work

9. Table showing interconnection of competencies, learning outcomes, assessment methods and criteria

Competencies of the EP graduate	Competences expressed in expected learning outcomes	Evaluation criteria	Name of the estimation method
Basic competencies			
BC1	LO1	formulates and presents theoretical foundations related to a scientific problem.	project, defense, scientific article
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO5	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	

		solves research tasks by developing and proposing non-standard or original approaches	
	LO7	formulates and presents theoretical foundations related to a scientific problem.	project
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
BC2	LO1	formulates and presents theoretical foundations related to a scientific problem.	project, defense, scientific article
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO6	formulates and presents theoretical foundations related to a scientific problem.	report
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO10	formulates and presents theoretical foundations related to a scientific problem.	publication
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
BC3	LO3	formulates and presents theoretical foundations related to a scientific problem.	report protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	

	PO4	formulates and presents theoretical foundations related to a scientific problem.	report
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
BC4	LO4	formulates and presents theoretical foundations related to a scientific problem.	report
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
BC5	LO2	formulates and presents theoretical foundations related to a scientific problem.	scientific article
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO7	formulates and presents theoretical foundations related to a scientific problem.	project
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO11	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
Professional competencies			
PC1	LO2	formulates and presents theoretical foundations	

		related to a scientific problem.	scientific article
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO6	formulates and presents theoretical foundations related to a scientific problem.	report
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO11	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
PC2	LO7	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO8	formulates and presents theoretical foundations related to a scientific problem.	team project
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO9	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned	

		justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
PC3	LO8	formulates and presents theoretical foundations related to a scientific problem.	team project
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
PC4	LO1	formulates and presents theoretical foundations related to a scientific problem.	project, defense, scientific article
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO6	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	
	LO9	formulates and presents theoretical foundations related to a scientific problem.	project protection
		uses analytical methods to provide a reasoned justification for a research task	
		solves research tasks by developing and proposing non-standard or original approaches	

10. Information about the modules of the educational program

Module code and name	Volume (labor intensity) of the module	Learning outcomes	Learning outcomes assessment criteria	Disciplines forming the module Code and name
GENERAL EDUCATION MODULES				
BM7300- Humanitarian and pedagogical	20	LO3, LO4, LO10, LO11	- Reasonable application of psychological and pedagogical strategies in teaching and research activities - Possession of academic writing skills and honesty - Participation in scientific and philosophical discussions, demonstration of logic and ethics	SPS7007 Higher education: psychological and pedagogical development strategies
				LAN7001A Foreign language (professional)
				SPS7001 History and philosophy of science
				PP7301 Teaching practice
BASIC MODULES				
BM7303- Research Methodology and Practice	15	LO1, LO2, LO3, LO10	- Building a scientific hypothesis and choosing an adequate methodology - Conducting research practice - Possession of skills in scientific analysis and presentation of results	RM7301 Research Methodology
				PP7302 Research practice
BM7305- Modern Web and Blockchain Technologies	8	LO1, LO2, LO5	- Justifies the architecture, selects a platform, applies smart contracts - Identifies potential threats, suggests protection mechanisms - Apply modern frameworks and REST/GraphQL API, implements adaptability	SFT7311 Theory and Technology of Blockchain
				SFT7301 Advanced Web-technologies
PROFESSIONAL MODULES				
			- Development and application of intelligent algorithms	ANL7308 Theory of mass service
				ANL7316 Neural networks in data analysis

PM7300- Intelligent Systems and Probabilistic Models	11	LO1, LO2, LO5, LO6, LO7	- Application of probabilistic models for forecasting and analysis - Solving problems using neural networks and decision-making methods	ANL7311 Generative-adversarial networks
				ANL7312 Markov chains and decision-making processes
				ANL7306 Computer Vision
PM7302- Modern Development and Data Analysis Methods	15	LO6, LO7, LO9	- Analyzes computational complexity, applies optimality criteria - Use DevOps and automation of development processes - Apply machine learning methods to real data	SFT7305 DevOps
				SFT7315 Algorithms in graph theory
				ANL7305 Machine Learning and Computer Statistics
PM7303- IT Project Management and Software Reengineering	11	LO2,LO6,LO8	-Apply reengineering methods to improve development efficiency -Plan, manage and evaluate the life cycle of an IT project	SFT7303 Software Development Management and Reengineering
				SFT7310 Project Management in IT
PM7304- Intelligent Distributed Systems and Enterprise Computing	10	LO1,LO2,LO6,LO8	-Configure and administer servers in a Linux-based enterprise environment -Develops IoT architecture, applies AI to process sensor data -Applies federated learning approaches, evaluates distributed models -Design a fault-tolerant, scalable enterprise network -Apply methods to collect, analyze, and visualize data from a web environment	NET7303 Enterprise Linux in Corporate Networks
				SFT7308 IoT and Artificial Intelligence
				SFT7314 Federated Computing
				NET7304 Corporate Networks Design
				ANL7307 Web Data Analysis

11. Information about the disciplines of the educational program

№	Discipline Code and Name	Brief description of the discipline (30-50 words)	Labor intensity of discipline in credits	Learning outcomes formed (codes)	Prerequisites	Postrequisites
Cycle of basic disciplines (BD) University component (UC)						
1.	Higher education: psychological and pedagogical development strategies	The discipline focuses on studying psychological and pedagogical strategies for the development of higher education, as well as forming competencies in designing and organizing the educational process. Master's students will master modern psychological and pedagogical approaches to teaching, methods for diagnosing and assessing students, as well as digital and inclusive education technologies. Special attention is given to the development of pedagogical, research, and communication skills, as well as the prevention of professional burnout among educators. Upon completion of the course, students will be able to develop and implement effective educational strategies in universities.	6	LO3,LO4,LO11		
2.	Foreign language (professional)	It is a one-semester practical course that tailors the English language program to the Master's students'		LO3		

		professional/research needs. During the course the Master's students will work on an individual project and a research portfolio. By the end of the course, students will organize and present research portfolio.				
3.	History and philosophy of science	The purpose of the discipline is to form the skills of working with scientific literature; logical, systematic, and critical thinking skills. The discipline will study: the main stages of the development of science; history and philosophy of science to form a conscious attitude to the environment and history, the basic principles of research activities.		LO3		
Cycle of basic disciplines (BD) Elective component (EC)						
4.	Algorithms in graph theory	During the course, the main concepts of graph theory, graph connectivity. Optimization tasks set graph theory: problems of finding optimal paths and location problems, algorithms from the solution are given. A special type of graph is considered - trees and related tasks with them:finding the shortest spanning tree and finding the maximum directed forest, as well as using	5	LO4	Algorithms and data structures	Optimization, Network Algorithms

		trees for storing information.				
5.	Machine Learning and Computer Statistics	The course includes topics such as supervised learning (linear learning models, neural networks, reference vector machines); teaching without a teacher (clustering, reduction of dimension); learning theory (CV theory; large fields). It discusses modern areas of application of machine learning, such as robotic control, data mining, autonomous navigation, speech recognition, as well as text and web data processing.	5	LO6,LO7,LO10	Linear algebra, probability theory	Neural networks, computer vision
6.	DevOps	This course examines the key concepts and principles of DevOps, organizational factors and automation tools in the development of software products in this way. After completing this course, master students will be able to synchronize the stages of software product development, QA, automate tasks, and apply a methodology that helps automate workflows, which will increase the speed and productivity of developers,	5	LO6,LO7	Linux in corporate networks	

		testers and system administrators.				
Cycle of major disciplines (MD) University component (UC)						
7.	Research Methodology	The study of types of scientific research, the methodology of scientific knowledge, research, the formation of conclusions and conclusions, writing scientific articles and reports at the conference, summarizing the results of research work in a dissertation, its structure and content.	5	LO1,LO2		
8.	Advanced Web Technologies	The course covers concepts, technologies and methods for creating a large-scale distributed software system using service-oriented computing and cloud applications. In-depth study of advanced technologies focused on web standards, interactivity and design.	4	LO7	Web programming	
9.	Theory and Technology of Blockchain	The purpose of this course is to introduce master students to blockchain technology, its capabilities and prospects. The course examines the mathematical, cryptographic foundations and the use of this technology for solving applied problems (smart contracts, supply chain management,	4	LO6,LO7		

		digital signatures and algorithms for their verification).				
10.	Project Management in IT	To familiarize master's students with the theoretical and practical foundations of project management in the field of information technology, as well as teams of developers, to develop practical skills in preparing and managing projects, and to teach the ability to communicate with a team to achieve productive activities.	6	LO8		
11.	Software Development Management and Reengineering	The purpose of this course is to teach master students to analyze and design software, manage a team in the software development process, determine and evaluate the degree of responsibility of project team members.	5	LO7	The basis of software engineering	
Cycle of major disciplines (MD) Elective component (EC)						
12.	Web Data Analysis	Studying web data mining methods for solving various problems of analytical processing, creating models for analyzing structured and semi-structured web data.	5	LO6,LO7	Machine learning	
13.	Generative-adversarial networks	Brief course description This discipline is devoted to the latest methods of	5	LO6,LO7,LO10	Neural networks in data analysis	

		generative-adversarial networks, and their use to create realistic images and three-dimensional structures. Upon mastering the discipline students should know: the concept and organization of the generative model; the concept and organization of the discriminative model; be able to: train generative-adversarial networks and generate images using them, from basic handwritten digits, to restoration, correction, coloring of photographs; generate 3D. Expected learning outcomes Upon successful completion of the course, students will be able to: - Possess an advanced understanding of the principles of generative-adversarial networks, their structure and basic components. - Design and train generative-adversarial models for different types of data such as images, text, sound and others. - apply GSS in various domains such as computer vision, natural language				

		processing, content generation and other creative applications. - tune and optimize GSS parameters to achieve better results in various tasks.				
14.	Computer Vision	Introduction to computer vision, image and video analysis for the recognition, reconstruction and modeling of objects in a three-dimensional world. The basics of image formation, camera image geometry, detection and comparison of characteristics, image classification, deep learning using neural networks are considered.	5	LO6,LO7,LO10	Machine learning	
15.	Markov chains and decision-making processes принятия решений	Brief course description This discipline involves the study of Markov chains, in which each element is completely determined by the previous one. These chains are widely used in the formulation of tasks of linking artificial intelligence to the behavior of an agent in a certain environment, for example, a robot in a real environment, on which, for example, reinforcement learning is based. Expected learning	5	LO6,LO7,LO10	Theory of mass service	Federated calculations

		outcomes Upon successful completion of the course, students will be able to: - work with methods of building probabilistic models describing stochastic dynamics of processes; - perform sampling and estimation; - develop a mass service system - be able to establish properties of solutions of stochastic systems.				
16.	Neural networks in data analysis	The purpose of the course is to study the basics of neural networks and their application to solve data analysis problems. The discipline focuses on the theoretical aspects and practical use of modern models.	6	LO6,LO7,LO9	Machine learning	Generative - competitive networks, Computer vision
17.	Corporate Networks Design	The course is aimed at gaining knowledge and acquiring skills necessary for designing a corporate network, including modern solutions for addressing and routing. It covers concepts such as modern corporate networks, WANs, security services, network services, and SDA with software access.	5	LO6,LO7	Network technologies	Linux in corporate networks
18.	Theory of mass service	Brief course description The aim of this course is - Formation of	6	LO6,LO7,LO10	Mathematical analysis, Probability theory	Markov chains and decision processes

		skills of mathematical modeling of service processes and ability to assess the quality of service management using mathematical methods. Expected learning outcomes Upon successful completion of the course, students will be able to: - Knowledge of the elements of probability theory and the theory of random processes used in the study of mass service systems; - Ability to build mathematical models of WSC functioning, possession of analytical methods of calculation of service quality indicators and appropriate mathematical apparatus;				
19.	Federated Computing	Brief course description The course aims to develop an understanding of the basic principles of federated computing, including secure data transfer and inter-device reconciliation. It also provides programming skills to implement federated algorithms. This may include the use of specialized libraries and frameworks.	5	LO7	Machine learning	

		Expected learning outcomes Upon successful completion of the course, students will be able to: - Apply federated computing to specific tasks such as machine learning, data analysis, and natural language processing; - Be able to provide data security in federated computing, including encryption, authentication, and other techniques;				
20.	IoT and Artificial Intelligence	The aim of this course is to teach master students advanced artificial intelligence methods that can be useful for industrial automation, environmental assessment, as well as for human-computer interaction, etc.	5	LO5,LO6		Federated Computing
21.	Enterprise Linux in Corporate Networks	The course aims to study the administration of the Linux operating system. Attention is focused on the fundamental concepts of Linux and its main tasks. It discusses the application of the command line concept and enterprise tools level.	5	LO6,LO7	Operating systems	DevOps
22.	RW7000 The research work of a student, including an internship and implementation of master's thesis	The discipline "Research Work of the Master's Student" is aimed at developing research	24	LO1, LO2, LO3, LO5, LO10	research practice	defense of master's thesis

		competencies necessary for the completion of a qualification work — the master's thesis. Within the framework of this discipline, the master's student undergoes a research internship, learns methods of formulating and solving scientific problems, analyzes theoretical and applied aspects of the research topic, conducts experimental and analytical work, and presents the results in accordance with academic standards.				

12. Curriculum of the educational program (Platonus)

Module code	Module name	Discipline cycle	Discipline component	Code of subject	Subject name	Academic credits	Control in the academic period			Volume of hours							Distribution of credits per academic period			
												including			MSIWT	MSIW	1 course		2 course	
																	1	2	3	4
																	Number of weeks in the academic period			
							Exams	Practice/SRW	Term paper/project	Total	In-class learning	Lectures	Practice	Lab practicals			15	15	15	15
Modules of specialty/education programm																				
1	PM7302-Modern Development and Data Analysis Methods	BS	ES	SFT7305	DevOps	5	1			150.0	45.0	15	0	30	15	90	5.0			
2		BS	ES	ANL7305	Machine Learning and Computer Statistics	5	3			150.0	45.0	15	0	30	15	90			5.0	
3		BS	ES	SFT7315	Algorithms in graph theory	5	1			150.0	45.0	15	0	30	15	90	5.0			
4	BM7305-Modern Web and Blockchain Technologies	AS	UC	SFT7311	Theory and Technology of Blockchain	4	1			120.0	45.0	15	0	30	15	60	4.0			
5		AS	UC	SFT7301	Advanced Web-technologies	4	3			120.0	45.0	15	0	30	15	60			4.0	
6	PM7303-IT Project Management and Software Reengineering	AS	UC	SFT7303	Software Development Management and Reengineering	5	2			150.0	45.0	15	0	30	15	90		5.0		
7		AS	UC	SFT7310	Project Management in IT	6	3			180.0	60.0	15	15	30	15	105			6.0	
8	BM7303-Research Methodology and Practice	AS	UC	RM7301	Research Methodology	5	2			150.0	45.0	15	30	0	15	90		5.0		
9		AS	UC	PP7302	Research practice	8		240		240.0		0	0	0	0	0				8.0
10	BM7300-Humanitarian and pedagogical	BS	UC	SPS7007	Higher education: psychological and pedagogical development strategies	6	1			180.0	60.0	30	30	0	15	105	6.0			
11		BS	UC	LAN 7001A	Foreign language (professional)	5	1			150.0	45.0	0	45	0	15	90	5.0			
12		BS	UC	SPS7001	History and philosophy of science	5	2			150.0	45.0	30	15	0	15	90		5.0		
13		BS	UC	PP7301	Teaching practice	4		120		120.0		0	0	0	0	0		4.0		
14	PM7300-Intelligent Systems and Probabilistic Models	AS	ES	ANL7316	Neural networks in data analysis	6	1			180.0	60.0	15	15	30	15	105	6.0			
15				ANL 7308	Theory of mass service		1				60.0	15	15	30	15	105				
16		AS	ES	ANL7311	Generative-adversarial networks	5	2			150.0	45.0	15	0	30	15	90		5.0		
17				ANL7312	Markov chains and decision-making processes		2				45.0	15	0	30	15	90				
18				ANL7306	Computer Vision		2				45.0	15	0	30	15	90				
19		AS	ES	NET7303	Enterprise Linux in Corporate Networks	5	3			150.0	45.0	15	0	30	15	90			5.0	

20	PM7304-Intelligent Distributed Systems and Enterprise Computing	AS	ES	SFT7308	IoT and Artificial Intelligence	5	3			150.0	45.0	15	0	30	15	90			5.0	
21				SFT7314	Federated Computing		3				45.0	15	0	30	15	90				
22				NET7304	Corporate Networks Design		3				45.0	15	0	30	15	90				
23				ANL7307	Web Data Analysis		3				45.0	15	0	30	15	90				
Additional modules beyond qualification																				
24	Scientific research work	RW	CS	RW7000	The research work of a student, including an internship and implementation of master's thesis	2		60		60.0		0	0	0	0	0	2.0			
25		RW	CS	RW7001	The research work of a student, including an internship and implementation of master's thesis (NIRM)	3		90		90.0		0	0	0	0	0		3.0		
26		RW	CS	RW7002	The research work of a student, including an internship and implementation of master's thesis	5		150		150.0		0	0	0	0	0			5.0	
27		RW	CS	RW7003	The research work of a student, including an internship and implementation of master's thesis	14		420		420.0		0	0	0	0	0				14.0
Weekly average workload at hours																	0	0	0	0
2	**Base requirements(BS)**					**35**		**120**	**0**	**1050**	**285**	**105**	**90**	**90**	**90**	**555**	**21**	**9**	**5**	**0**
	University component(BS/UC)					20		120	0	600	150	60	90	0	45	285	11	9	0	0
	Electives(BS/ES)					15		0	0	450	135	45	0	90	45	270	10	0	5	0
3	**Profession requirements(VRS)**					**53**		**240**	**0**	**1590**	**435**	**135**	**60**	**240**	**135**	**780**	**10**	**15**	**20**	**8**
	University component(VRS/UC)					32		240	0	960	240	75	45	120	75	405	4	10	10	8
	Electives(VRS/ES)					21		0	0	630	195	60	15	120	60	375	6	5	10	0
Total of theoretical course						88	15	360	0	2640	720	240	150	330	225	1335	31.0	24.0	25.0	8.0
USRW/UERW/DSRW						24	0	720	0	720	0	0	0	0	0	0	2.0	3.0	5.0	14.0
AC	**Additional courses**										0									
FA	**Final attestation**					8				240.0										
	Registration and defense of a master's thesis					8		4		240										
	Total					120		1084		3600	720	240	150	330	225	1335				