AGREED
Chairman of the
Educational and Methodological
Council of JSC «International Information
Technology University»

Mustafina A.
«12» December 2024 Protocol of the EMC № 3

APPROVED
Chairman of the Board-Rector of JSC
«International Information
Technology University»

Issakhov A.
«28» February 2025 Protocol of the AC № 10

EDUCATIONAL PROGRAM

8D06101 Clever systems

Code and classification of the field of education: 8D06 Information and

Communication Technologies

Code and classification of training area: 8D061 Information and Communication Technologies

Group of educational programs: D094 Information Technologies

ISCED level: 8

NQR level: 8

ORC level: 8

Academic degree awarded: Doctor of Philosophy (PhD) in the educational program “8D06101 Clever systems”

Duration of study: 3 years

Number of credits: 180

AGREED
“Yellow Cloud Technologies” LLP

Director Sadykov N.R.
«__» _____ 2025

AGREED
“Zerone Technology” LLP

Director Rashidinov D.
«__» _____ 2025

Almaty, 2025

The code and name of the educational program: "8D06101 Clever systems"

№	Educational program developers (Position, scientific degree, academic degree, Full name)	Signature
1	Professor of the Department of Information Systems, Doctor of Technical Science, Professor Naizabayeva Lyazat	
2	Senior lecturer of the Department of Information Systems, Master of technical sciences Auyezova Anel	

Contents

List of abbreviations and acronyms

BC	Basic competence
BM	Basic module
HE	Higher education
GOSO	State obligatory standard of education
ECR	European Qualifications Framework
ETF	European Training Foundation
ZUN	Knowledge, skills, skills
NKZ	National Classifier of Occupations
NQF	National Qualifications Framework
NQS	National Qualifications System
OGM	General humanitarian module
OM	General module
OP	Educational program
OPM	General professional module
OQF	Sectoral Qualifications Framework
OK	General educational competence
PS	Professional Standard
Air Defense	Postgraduate Education
PC	Professional competence
PM	Professional module
WG	Working Group
RK	Republic of Kazakhstan
RO	Learning Outcome
CM	Special module
QMS	Quality management system
SEM	Socio-economic module
TVE	Technical and Vocational Education
TVET	Technical and Vocational Education and Post-Secondary education
UNESCO	United Nations Educational, Scientific and Cultural Organization/
UNESCO	is a specialized agency of the United Nations Educational, Scientific and Cultural Affairs.
Cedefop	European Center for the Development of Vocational Training
DACUM	from English Developing Curriculum
ECVET	European Credit System for vocational education and training
EQAVET	European Quality Assurance in Vocational Education and Training
ENQA	EuropeanAssociationforQualityAssuranceinHigherEducation / European - Russian Association for Quality Assurance in Higher Education
ESG	Standards and Guidelines for Quality Assurance in the European Higher Education Area
FIBAA	International agency (non-profit foundation) for accreditation and examination of the quality of higher education (Bonn, Germany)
IQM-HE	Internal Quality Management in Higher Education
TACIS	Technical Assistance for the Commonwealth of Independent States
WSI	WorldSkills International

1. Description of the educational program

This educational program (EP) was developed on the basis of professional standards (PS) of the National Chamber of Entrepreneurs "Atameken," the National Qualifications Framework (NQF), the Sectoral Qualifications Framework (SQF) in the field of information technology, and regional training standards (RS), relying on research and trends indicated in the Atlas of New Professions and Competencies (ANPC) of Kazakhstan in the field of information technology.

An intelligent system is an advanced computer system that can collect, analyze, and respond to data it gathers from the environment. An intelligent system can operate and communicate with other agents, such as users or other computer systems, can learn from its own experience and adapt to current data. An intelligent system can also support remote monitoring and control. Intelligent systems automate work tasks and create intelligent environments; they enable machines to communicate with each other, for example, in the areas of mobile payments, healthcare, traffic, security, or surveillance, etc.

In this educational program, doctoral students will develop and implement solutions for consumer technologies such as smart cities, homes, and more. Doctoral students will study intelligent data analysis, machine learning, deep learning, neural networks, and more. In addition, they will plan, develop, and implement projects in intelligent information systems and the Internet of Things.

The PhD-level educational program represents joint training for all IT programs and provides professional qualifications:

- in the field of knowledge representation and processing in intelligent systems,
- in the field of studying methods for constructing logical models and their use in intelligent systems of various purposes: fuzzy systems, decision support systems, neural networks, and genetic algorithms.

Theoretical research is aimed at studying intellectual processes and creating corresponding mathematical models. Experimental work is carried out by developing computer programs and creating machines that solve particular intellectual tasks or behave reasonably in a given situation. The educational program will contribute to the formation in doctoral students of skills and competencies in the areas of solving design and management tasks based on artificial intelligence methods, advanced technologies, and software development for modern intelligent systems.

2. Aim and objectives of the educational program

The purpose of the EP - Training competent research personnel to meet the needs of science, education, and industry in the field of modern intelligent systems.

AP objectives:

1. to familiarize with concepts and methods forming the basis for understanding modern achievements in artificial intelligence;
2. to present the technical formulation of the main tasks solved by artificial intelligence systems;
3. to introduce modern research areas in artificial intelligence;
4. to familiarize with the main models of knowledge representation and intelligent systems;
5. to develop intelligent information systems or knowledge-based systems.

A doctoral student must possess skills in data analysis and analytical generalization of the results of scientific research using modern achievements of science and technology, the study, analysis, and generalization of scientific and technical information on the subject of the dissertation research, the ability to create theoretical models that allow predicting the properties of the studied objects, and to develop proposals for the implementation of results.

3. Passport of the academic program

№	Name	Description
1.	Education area code and classification	8D06 Information and Communication Technologies
2.	Training direction code and classification	8D061 Information and Communication Technologies
3.	Group of academic programs	D094 Information Technologies
4.	Name of the educational program	8D06101 Clever Systems
5.	Aim of the educational program	Training competent research specialists to meet the needs of science, education, and industry in the field of modern intelligent systems.
6.	Type of the educational program	New
7.	Level according to the National Classifications Framework	8
8.	Level according to the Sectoral Qualifications Framework	8
9.	Distinctive features of the program	No
10.	Partner University	No
11.	Academic degree awarded	Doctor of Philosophy (PhD) in the Educational Program "8D06101 Clever Systems"
12.	Duration of study	3 years
13.	Volume of credits	180 ECTS
14.	Language of education	English
15.	Atlas of new professions	Developer of General Artificial Intelligence, Engineer-Developer of Artificial Neural Networks
16.	Regional standard	No
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	The learning outcomes reflect the goals, context, and content of the educational program, correspond to the level of doctoral training, and are interconnected, achievable, and verifiable. A doctoral student must possess in-depth knowledge of modern theories, methods, and technologies in the field of intelligent systems, including related disciplines (artificial intelligence, big data analysis, cybersecurity, digital transformation, etc.), demonstrate the ability to conduct independent scientific research, formulate and solve relevant scientific problems, and develop new models, methods, and algorithms. He/she must critically comprehend and analyze scientific data, integrate interdisciplinary knowledge into professional and research activities, as well as publish results in peer-reviewed journals and present them at international scientific platforms. All learning outcomes are embedded in the academic

		workload of the program and are assessed using comprehensive methods and transparent criteria.

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

№	Name of the PS	Profession card	Labor functions
1.	Software Testing	Researcher in the Field of ICT	1. Analysis of problems to develop solutions using computer hardware and software. 2. Defining the purpose, objectives, and scientific framework of the research. 3. Conducting research, experiments, and collecting evidence-based data on the topic.

5. List of the EP competencies

BC1: ability to know the basic algorithms of intelligent systems, the patterns of intellectual processes, methods of data analysis, processing, and representation using data science;
BC2: ability to effectively carry out planning, implementation, configuration, and support of an organization's computer infrastructure;
BC3: ability to acquire, through advanced modern technologies, and apply in practice new knowledge and skills, including in new fields of knowledge not directly related to the area of activity;
BC4: proficiency in methods and tools for obtaining, storing, processing, and transmitting information through modern computer technologies in intelligent systems;
BC5: culture of thinking, ability to build the logic of reasoning and statements based on the interpretation of data integrated from different fields of science and technology, and to make judgments on the basis of incomplete data;
BC6: ability to organize interaction between a team of developers and a client; making managerial decisions under conditions of differing opinions;
BC7: ability to analyze and evaluate the levels of one's competencies in combination with the ability and readiness for self-regulation of further education and professional mobility;
BC8: ability to know and apply the fundamentals of neural network design, their basic customization and configuration.
PC1: ability to analyze professional information, identify the main points, structure it, format and present it in the form of analytical reviews with substantiated conclusions and recommendations;
PC2: ability to develop technical specifications of technical conditions; formulate technical requirements and efficiency criteria for intelligent systems;
PC3: ability to develop new methods for designing and developing intelligent systems;
PC4: ability to build knowledge representation models, approaches and techniques for solving artificial intelligence tasks, intelligent knowledge models, and methods of knowledge representation (knowledge engineering methods);
PC5: ability to develop and program human-computer interaction, solve optimization problems using artificial intelligence algorithms;
PC6: ability to develop methods for solving non-standard problems and new approaches to solving traditional problems;
PC7: ability to develop design strategies, define design goals, efficiency criteria, and applicability constraints;

PC8: ability to forecast the development of intelligent systems and advanced information technologies;
PC9: ability to develop competitive ideas in the theory and practice of advanced technologies and intelligent systems;
PC10: ability to professionally operate modern equipment and devices (in accordance with the objectives of the doctoral program);
PC11: ability to design and develop a universal self-learning AI;
PC12: ability to conduct personnel training.

6. List of learning outcomes of the EP

LO1: design models and develop the architecture of artificial neural networks for specific subject domains;
LO2: propose substantiated applications or explanatory notes for research projects in the field of intelligent systems;
LO3: apply big data processing methods and data mining techniques to solve resource-intensive tasks;
LO4: apply machine learning algorithms and implement them in intelligent systems;
LO5: generate original new scientific ideas in a specific subject area and communicate them to the scientific community;
LO6: formulate research problems and find ways to solve them based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization;
LO7: develop intelligent information systems and their components based on modern data science methods;
LO8: demonstrate patterns of cognition of intellectual processes, methods of searching, processing, and presenting professionally significant data;
LO9: develop algorithms and rules for analysis, decision-making, operation, learning and self-learning, communication, interaction, and the development of general AI;
LO10: evaluate one's own and known scientific research and prepare analytical materials for developing strategic decisions in the field of intelligent systems.

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
BC1	V	V								
BC2	V	V								
BC3			V	V						
BC4			V	V						
BC5					V					
BC6						V				
BC7							V	V		
BC8									V	V
PC1	V									
PC2		V	V	V						
PC3		V	V	V						
PC4		V		V						
PC5		V	V	V						
PC6					V					
PC7					V					

PC8					V					
PC9						V				
PC10							V	V		V
PC11							V	V	V	V
PC12									V	V

8. The relationship of LO with labor functions

№	LO	Labor functions
1.	LO1: design models and develop the architecture of artificial neural networks for specific subject domains;	1. Analysis of problems for developing solutions using computer hardware and software. 2. Defining the research purpose, objectives, and scientific framework. 3. Conducting research and experiments, and collecting evidence-based data on the topic.
2.	LO2: propose substantiated applications or explanatory notes for research projects in the field of intelligent systems;	Analysis of problems for developing solutions using computer hardware and software.
3.	LO3: To use big data processing and data mining techniques to solve resource-intensive tasks.;	Conducting research and experiments, and collecting evidence-based data on the topic.
4.	LO4: apply machine learning algorithms and implement them in intelligent systems;	Conducting research and experiments, and collecting evidence-based data on the topic.
5.	LO5: generate original new scientific ideas in a specific subject area and communicate them to the scientific community;	Analysis of problems for developing solutions using computer hardware and software.
6.	LO6: formulate research problems and find ways to solve them based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization;	Defining the research purpose, objectives, and scientific framework.
7.	LO7: develop intelligent information systems and their components based on modern data science methods;	1. Analysis of problems for developing solutions using computer hardware and software. 2. Defining the research purpose, objectives, and scientific framework.
8.	LO8: demonstrate patterns of cognition of intellectual processes, methods of searching, processing, and presenting professionally significant data;	Defining the research purpose, objectives, and scientific framework.
9.	LO9: develop algorithms and rules for analysis, decision-making, operation, learning and self-learning, communication, interaction, and the development of general AI;	1. Defining the research purpose, objectives, and scientific framework. 2. Conducting research and experiments, and collecting evidence-based data on the topic.

3.	LO10: evaluate one's own and known scientific research and prepare analytical materials for developing strategic decisions in the field of intelligent systems.	Conducting research and experiments, and collecting evidence-based data on the topic.

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: ability to know the basic algorithms of intelligent systems, the patterns of intellectual processes, methods of data analysis, processing, and representation using data science;	LO1, LO2	1. Critically evaluates existing models and architectures of artificial neural networks, correlating them with the tasks of specific subject domains. 2. Applies methods of big data analysis and data mining to design and optimize neural network architectures. 3. Prepares explanatory notes or project proposals demonstrating knowledge of modern algorithms of intelligent systems and data analysis methods.	Exam, Project, Practical work, Research article
BC2: ability to effectively carry out planning, implementation, configuration, and support of an organization's computer infrastructure;	LO1, LO2	1. Critically evaluates existing neural network architectures and determines their applicability for implementation in an organization's infrastructure. 2. Formulates proposals for the integration and scaling of neural network architectures within corporate or research IT infrastructure.	Project, Research report
BC3: ability to acquire, through advanced modern technologies, and apply in practice new knowledge and skills, including in new fields of knowledge not directly related to the area of activity;	LO3, LO4	1. Critically evaluates modern methods of Big Data and machine learning in various subject domains. 2. Masters and adapts new technologies for solving research and applied tasks. 3. Applies machine learning algorithms and data mining in practice.	Research and Development Work (R&D), Research article, Research report, Presentation,
BC4: proficiency in methods and tools for obtaining, storing, processing, and transmitting information through modern computer technologies in intelligent systems;	LO3, LO4	1 Applies modern data storage and processing technologies for the implementation of machine learning algorithms. 2 Develops and configures methods of data transmission and integration in intelligent systems. 3 Evaluates the effectiveness of using various data science technologies for solving resource-intensive tasks.	Exam, Research and Development Work (R&D), Research report, Project, Presentation, Research article.

BC5: culture of thinking, ability to build the logic of reasoning and statements based on the interpretation of data integrated from different fields of science and technology, and to make judgments on the basis of incomplete data;	LO5	1. Formulates research problems based on the analysis and interpretation of incomplete or heterogeneous data. 2. Generates and substantiates new scientific ideas by integrating knowledge from different fields of science and technology. 3. Applies methods of data mining, machine learning, and complexity theory to identify solutions.	Research article, Research report
BC6: ability to organize interaction between a team of developers and a client; making managerial decisions under conditions of differing opinions;	LO6	1. Plans and coordinates team activities in the development of intelligent information systems. 2. Justifies managerial decisions based on the analysis of professionally relevant data. 3. Demonstrates the ability to reconcile positions and reach compromises in the design of intelligent systems.	Research and Development Work (R&D), Research article, Case analysis, Research report, Presentation.
BC7: ability to analyze and evaluate the levels of one's competencies in combination with the ability and readiness for self-regulation of further education and professional mobility;	LO7 LO8	1. Evaluates own and external research in the field of intelligent systems. 2. Develops analytical materials to support strategic decision-making. 3. Plans personal professional development with regard to current trends in artificial intelligence and data science.	Case analysis, Project, Presentation, Research report, Research and Development Work (R&D).
BC8: ability to know and apply the fundamentals of neural network design, their basic customization and configuration.	LO9, LO10	1. Designs neural network architectures for solving applied problems. 2. Implements and configures machine learning algorithms in intelligent systems. 3. Develops algorithms for self-learning and communication of general artificial intelligence.	Research report, Presentation, Research and Development Work (R&D), Methodological development, Case analysis.
Professional competencies			
PC1: ability to analyze professional information, identify the main points, structure it, format and present it in the form of analytical reviews with substantiated conclusions and recommendations;	LO1	1. Conducts in-depth analysis of professional information using modern methods of critical and systems thinking. 2. Identifies key ideas and trends within large volumes of data and structures analytical material logically. 3. Presents analysis results in a scientifically sound format, considering the needs of the target audience.	Analytical report, Research article
PC2: ability to develop technical specifications of technical conditions; formulate technical	LO2, LO3, LO4	Formulates goals, functional and non-functional requirements for the information system.	Project, Case analysis,

requirements and efficiency criteria for intelligent systems;			Research report.
PC3: ability to develop new methods for designing and developing intelligent systems;	LO2, LO3, LO4	1. Generates original scientific ideas in the field of information systems design. 2. Develops new methods for constructing intelligent systems and their components.	Research and Development Work (R&D), Research article. Research report.
PC4: ability to build knowledge representation models, approaches and techniques for solving artificial intelligence tasks, intelligent knowledge models, and methods of knowledge representation (knowledge engineering methods);	LO2 LO4	1. Applies knowledge engineering methods to construct ontologies, semantic, and logical models of knowledge representation. 2. Selects and justifies AI approaches and techniques based on the nature of the task and the type of knowledge.	Research and Development Work (R&D), Research article. Project.
PC5: ability to develop and program human-computer interaction, solve optimization problems using artificial intelligence algorithms;	LO2, LO3, LO4	1. Designs human-computer interaction interfaces based on UX/UI principles, adaptability, and accessibility. 2. Implements software solutions to ensure effective user interaction with intelligent systems. 3. Develops solutions to non-standard problems based on machine learning methods.	Project, Research and Development Work (R&D), Research report.
PC6: ability to develop methods for solving non-standard problems and new approaches to solving traditional problems;	LO5	Develops original methods and approaches to problem-solving using modern AI tools.	Research and Development Work (R&D), Research article.
PC7: ability to develop design strategies, define design goals, efficiency criteria, and applicability constraints;	LO5	Formulates the goals of information system design, taking into account the specifics of tasks and application context.	Project, Research report.
PC8: ability to forecast the development of intelligent systems and advanced information technologies;	LO5	Analyzes current trends and directions in the development of information systems and technologies.	Research and Development Work (R&D), Research article.
PC9: ability to develop competitive ideas in the theory and practice of advanced technologies and intelligent systems;	LO6	1. Generates new scientific ideas in the field of advanced technologies. 2. Develops and substantiates competitive concepts in the theory and practice of information systems. 3. Evaluates peer research and formulates own recommendations for the advancement of the field.	Research and Development Work (R&D), Research article, Project.

PC10: ability to professionally operate modern equipment and devices (in accordance with the objectives of the doctoral program);	LO7, LO8, LO10	1. Uses modern equipment for the development of information systems. 2. Configures and operates equipment in accordance with the objectives of research projects. 3. Evaluates the efficiency of equipment performance in the implementation of intelligent systems.	Practical work, Research report, Research and Development Work (R&D), Project.
PC11: ability to design and develop a universal self-learning AI;	LO7, LO8, LO9, LO10	1. Plans and coordinates the stages of AI product development, taking into account tasks, timelines, and resource allocation. 2. Ensures synchronization of technical, research, and management components of the project.	Research article, Research report, Methodological development, Report.
PC12: ability to conduct personnel training.	LO9, LO10	1. Develops training programs for personnel in the field of intelligent systems. 2. Designs instructional materials and methodological guidelines. 3. Conducts training and evaluates its effectiveness.	Methodological development, Presentation.

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
		BASIC MODULES		
BM8101 Artificial Intelligence and Data Analysis	8 credits	LO1: Design models and develop the architecture of artificial neural networks for specific subject areas LO3: To use big data processing and data mining techniques to solve resource-intensive tasks. LO4: Apply machine learning algorithms and implement them in intelligent systems. LO6: Formulate research problems and identify solutions based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization. LO7: Develop intelligent information systems and their components using modern methods of data science. LO8: Demonstrate patterns of cognition in intelligent processes, as well as methods for searching, processing, and representing professionally relevant data. LO9: Develop algorithms and rules for analysis, decision-making, work, learning and self-learning, communication, interaction and development of universal AI	1. Designs neural network architectures and machine learning algorithms for solving research and applied problems. 2. Applies Big Data methods and data mining techniques to identify patterns and optimize computational processes. 3. Evaluates the effectiveness of AI models and refines them based on the analysis of results. 4. Presents the outcomes of design and experiments in the form of scientific publications and presentations.	ANL8104 Clever Systems ANL8006 Intelligent Data Analysis ANL8103 Analysis Methods and Big Data Processing
BM8100 Scientific and Pedagogical Training	19 credits	LO2: Propose substantiated applications or explanatory notes for research projects in the field of intelligent systems LO5: Generate original scientific ideas in a specific subject area and communicate them to the scientific community. LO6: Formulate research problems and identify solutions based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization. LO10: Evaluate own and known scientific research and prepare analytical materials for the development of strategic decisions in the field of intelligent systems	1. Formulates and substantiates research problems, and develops teaching and methodological materials using modern educational technologies. 2. Applies pedagogical and scientific methods to teach students and colleagues in the field of intelligent systems. 3. Evaluates the quality of scientific research and educational practices from the perspective of critical analysis. 4. Presents scientific results and educational projects in academic and international contexts.	LAN8001A Academic Writing RM8001 Research Methods PP8100 Teaching Practice

PROFESSIONAL MODULES				
PM8100 Intelligent Modeling	18 credits	LO1: Design models and develop the architecture of artificial neural networks for specific subject areas LO4: Apply machine learning algorithms and implement them in intelligent systems. LO6: Formulate research problems and identify solutions based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization. LO7: Develop intelligent information systems and their components using modern methods of data science. LO9: Develop algorithms and rules for analysis, decision-making, work, learning and self-learning, communication, interaction and development of universal AI	1. Develops conceptual and mathematical models of intelligent systems using methods of machine learning and knowledge engineering. 2. Applies AI algorithms and modeling tools to construct and validate intelligent models. 3. Evaluates the applicability and validity of developed models in interdisciplinary research. 4. Documents and presents modeling results in scientific publications and presentations.	SFT8101 Theoretical Computer Engineering PP8101 Research Practice SFT8103 Modern Control Theory SFT8100 Current Issues in Forecasting SFT8102 Deep Learning Methods
Research Work	123 credits	LO2: Propose substantiated applications or explanatory notes for research projects in the field of intelligent systems LO5: Generate original scientific ideas in a specific subject area and communicate them to the scientific community. LO6: Formulate research problems and identify solutions based on models and methods of data mining, machine learning, neural networks, theories of computational complexity, and information optimization. LO10: Evaluate own and known scientific research and prepare analytical materials for the development of strategic decisions in the field of intelligent systems	1. Formulates scientific problems and develops project proposals or explanatory notes for research projects. 2. Applies modern methods of data analysis, modeling, and computation within research activities. 3. Evaluates obtained results, compares them with existing studies, and draws critical conclusions. 4. Presents research outcomes in the form of scientific articles, reports, and presentations in accordance with academic standards.	Doctoral research work, including internship completion and doctoral dissertation execution

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.	Academic Writing	"Academic Writing" is a compulsory component of the Ph.D. program offered to the IITU Ph.D. It is one-semester five-credit practical course that tailors the students' research skills and English language competence to their professional/research needs in academic writing. Students in this course will do a lot of reading activities, explore academic writing strategies and formats required at the graduate level, and get ready for independent academic writing for the Ph.D. program. By the end of the course, students will organize and present research portfolio, and write a research article outline.	5	LO8, LO10	-	Research and Development Work (R&D
2.	Research Methods	This course is to introduce research methodology in information technology for postgraduate candidate. The topics of this course are: the importance of Information Technology research, literature review methodology, some research methodology of Information Technology i.e. formal method, literature review, prototype development, experimental and evaluation. The students will be introduced to the differences between quantitative and qualitative studies. Then, the course will discuss the technique of result writing, such as report writing, paper writing, and thesis writing. The end of the course will discuss management of research, discussion in this topic will focus on research proposal writing, supervising research activities, and management of research results.	4	LO1, LO3, LO4	"Fundamentals of Research Activity"	-
3.	Clever systems	"Clever systems" familiarize PhD students with the problems and areas of use of artificial intelligence in information systems, coverage of theoretical and organizational and methodological issues of building and functioning of knowledge processing systems	4	LO1, LO3, LO4, LO5	Programming Technologies, Theory of Information Processes and Systems, Mathematical Foundations of Systems Theory	-
		Cycle of basic disciplines (BD) Elective component (EC)				

4.	Analysis Methods and Big Data Processing	This course explores methods for storing, analyzing and processing large amounts of data, as well as how to effectively analyze big data and extract business and socially significant information from it. The course introduces doctoral students to some of the key IT technologies they can use to manipulate, store, and analyze big data. The course covers the MapReduce programming paradigm for parallel processing and Hadoop, an open source framework that allows you to cheaply and efficiently implement MapReduce in business problems. Doctoral students will be able to design highly scalable systems that can receive, store and analyze large amounts of unstructured data in batch and / or in real time.	4	LO1, LO4, LO8, LO10	Database Management Systems, Object-Oriented Programming	
5.	Intelligent data analysis	This course describes the basics of data analysis methods such as classification, modeling and forecasting methods based on the use of decision trees, artificial neural networks, genetic algorithms, evolutionary programming, associative memory, fuzzy logic. Students will learn data analysis methods, including statistical methods: descriptive analysis, correlation and regression analysis, factor analysis, analysis of variance, component analysis	4	LO1, LO2, LO6, LO7	Statistical Data Analysis	-
		Cycle of major disciplines (MD) University component (UC)				
8	Theoretical Computer Engineering	Formation and development of general and professional competencies of a PhD student who will be able to provide a solution to complex problems and practical problems of designing, building and configuring computer systems, use and implement computer engineering technologies.	4	LO2 , LO3, LO7, LO9	Database Management Systems, Programming Technology, Decision Theory	-
		Cycle of major disciplines (MD) Elective component (EC)				
9	Modern Control Theory	To form a scientific understanding of management as a science, art and a specific type of human activity, the stages and ways of its formation and development in the Republic of Kazakhstan and abroad, as well as to form basic practical skills in the field of modern management.	4	LO6, LO11	IT Project Management	-
10	Actual problems in forecasting	In this discipline, students learn the basic principles, features of construction and the scope of application of predictive models. It provides a detailed overview and description of the classification and clustering of forecasting, and also focuses on practical problems solved in forecasting. To this end, students will implement predictive models using Python and the machine learning method, as well as introduce innovative engineering projects to develop predictive models for various purposes using modern design methods. In the process of educational activity, the software implementation of prognostic models for solving practical problems from various applications is carried out	4	LO1, LO3, LO4	Intelligent Data Analysis in Information Systems	-

12	Deep Learning	The course examines the methods of deep learning, training and deployment of neural networks. During training, students will experiment with data, workout parameters, neural network structure and other parameters to improve performance and expand the capabilities of neural networks, as well as deploy neural networks to solve real-world problems. Upon completion of the course, students will be able to solve their own problems using deep learning algorithms	4	LO1, LO4, LO6, LO8	Machine Learning, Natural Language Processing Methods, Analysis and Processing of Unstructured Data, Neural Networks	
	Research Cycle Compulsory Component					
	Research Work of the Doctoral Student, Including Internship and Dissertation Completion	Research work is a key component of the educational program and is aimed at developing the doctoral student's ability to conduct independent fundamental and applied research. Within this framework, the doctoral student formulates and addresses relevant scientific problems, develops new methods, models, and algorithms in the field of intelligent systems and related disciplines, and integrates the obtained results into the scientific and professional community. The internship ensures the expansion of academic and professional competencies, facilitates the establishment of international research collaborations, and enables the acquisition of advanced research methods and technologies. The completion and defense of the doctoral dissertation imply obtaining original scientific results that meet international standards, their validation at international conferences, and publication in peer-reviewed journals.	123	LO2, LO5, LO6, LO10	Academic Writing, Research Methods	

12. Curriculum of the educational program (Platonus)

№	Module name	Discipline cycle	Discipline component	Code of discipline	Name of discipline	Academic credits	Control in the academic period					Volume of hours							Distribution of credits per academic period					
							Exams	Differentiated test(exception)	Differentiated test(course paper)	Practice/SRW	Term paper/project	Total	In-class learning	including			DSIWT	DSIW	1 course		2 course		3 course	
														Lectures	Practice	Lab practicals			1	2	3	4	5	6
																			Number of weeks in the academic period					
																			15	15	15	15	15	15
1	PM8100 Intelligent modeling	MD	UC	SFT8101	Theoretical computer engineering	4	1					120.0	45.0	15	30	0	15	60	4.0					
2		MD	RC	PP 8101	Research practice	10				300		300.0		0	0	0	0	0		10.0				
3		MD	EC	SFT8103	Modern management theory	4	1					120.0	45.0	15	30	0	15	60	4.0					
4				SFT8100	Actual problems in forecasting		1						45.0	15	30	0	15	60						
5				SFT8102	Deep Learning		1						45.0	15	30	0	15	60						
6	BM8100 Scientific and pedagogical training	BD	UC	LAN8001A	Academic writing	5	1					150.0	45.0	0	45	0	15	90	5.0					
7		BD	UC	RM8001	Research methods	4	2					120.0	45.0	15	30	0	15	60		4.0				
8		BD	UC	PP 8100	Teaching practice	10				300		300.0		0	0	0	0	0		10.0				
9	BM8101 Artificial intelligence and data analysis	BD	UC	ANL8104	clever systems	4	1					120.0	45.0	15	30	0	15	60	4.0					
10		BD	EC	ANL8006	Intelligent data analysis	4	1					120.0	45.0	15	30	0	15	60	4.0					
11				ANL8103	Analysis Methods and Big Data Processing		1						45.0	15	30	0	15	60						
12	Scientific research work	RW	RC	RW8001	The research work of a PhD student, including an internship and implementation	5				150		150.0		0	0	0	0	0	5.0					

					of doctoral thesis																			
13		RW	RC	RW8002	The research work of a student, including an internship and implementation of master's thesis (NIRD)	10				300		300.0		0	0	0	0	0		10.0				
14		RW	RC	RW8003	The research work of a PhD student, including an internship and implementation of doctoral thesis	30				900		900.0		0	0	0	0	0			30.0			
15		RW	RC	RW8004	The research work of a PhD student, including an internship and implementation of doctoral thesis	30				900		900.0		0	0	0	0	0				30.0		
16		RW	RC	RW8005	The research work of a PhD student, including an internship and implementation of doctoral thesis	30				900		900.0		0	0	0	0	0					30.0	
17		RW	RC	RW8006	The research work of a PhD student, including an internship and implementation of doctoral thesis	18				540		540.0		0	0	0	0	0						18.0
Weekly average workload at hours																			0	0	0	0	0	0
1	**General education disciplines (GED)**					**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Required component (GED/RC)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component (GED/UC)					0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Elective component (GED/EC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	**Basic disciplines (BD)**	**27**		**0**	**0**	**300**	**0**	**810**	**180**	**45**	**135**	**0**	**60**	**270**	**13**	**14**	**0**	**0**	**0**	**0**
	Required component (BD/RC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component(BD/UC)	23		0	0	300	0	690	135	30	105	0	45	210	9	14	0	0	0	0
	Elective component (BD/EC)	4		0	0	0	0	120	45	15	30	0	15	60	4	0	0	0	0	0
3	**Major disciplines (MD)**	**18**		**0**	**0**	**300**	**0**	**540**	**90**	**30**	**60**	**0**	**30**	**120**	**8**	**10**	**0**	**0**	**0**	**0**
	Required component (MD/RC)	10		0	0	300	0	300	0	0	0	0	0	0	0	10	0	0	0	0
	University component (MD/UC)	4		0	0	0	0	120	45	15	30	0	15	60	4	0	0	0	0	0
	Elective component (MD/EC)	4		0	0	0	0	120	45	15	30	0	15	60	4	0	0	0	0	0
4	**Disciplines for the formation of professional competencies (BDFPC)**	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Required component (BDFPC/RC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component (BDFPC/UC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Elective component (BDFPC/EC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	**Disciplines of personal development and the formation of leadership qualities(BDPD)**	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Required component (BDFPC/RC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	University component (BDFPC/UC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Elective component (BDFPC/EC)	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total of theoretical course		45	6	0	0	600	0	1350	270	75	195	0	90	390	21.0	24.0	0.0	0.0	0.0	0.0
USRW/UERW/DSRW		123	0	0	0	3690	0	3690	0	0	0	0	0	0	5.0	10.0	30.0	30.0	30.0	18.0
AC	**Additional courses**								0											
FA	**Final attestation**	12						360.0												
	Writing and defending a doctoral dissertation	**12**				**6**		**360**												
	Total	**180**				**4296**		**5400**	**270**	**75**	**195**	**0**	**90**	**390**						