Institute of automation and information technologies
Department of cybersecurity, information processing and storage

EDUCATIONAL PROGRAM
7M06103 «Management of information systems»

Code and classification of the field of education: **7M06 «Information and communication technologies»**
Code and classification of training directions: **7M061 «Information and communication technologies»**
Group of educational programs: **M094 « Information technologies»**
Level based on NQF: **7**
Level based on IQF: **7**
Study period: **2 years**
Amount of credits: **120**

Almaty 2023

Educational program 7M06103 «Management of information systems» was approved at the meeting of K.I.Satbayev KazNRTU Academic Council
Minutes # 3 dated «27» October 2022.

Was reviewed and recommended for approval at the meeting of K.I.Satbayev KazNRTU Educational and Methodological Council
Minutes # 2 dated «21» October 2022.

Educational program 7M06103 «Management of information systems» was developed by Academic committee based on direction 7M061 «Information and communication technologies».

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Viktor V. Pokusov		Chairman	Kazakhstan Information Security Association	
Teaching staff:				
Ryshan Zh. Satybaldieva	Candidate of Technical Sciences	Head of the Department "Cybersecurity, Information Processing and Storage", Associate Professor	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", internal phone: 70-60	
Evgeniya Zh. Aitkhozhaeva	Candidate of Technical Sciences, docent	Associate Professor	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", internal phone: 73-61	
Galim Z. Kaziev	Doctor of Technical Sciences	Professor	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", internal phone: 73-61	
Dulat N. Shukaev	Doctor of Technical Sciences	Professor	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", internal phone: 73-61	
Birzhan I. Zhumagaliev	Candidate of Technical Sciences, docent	Associate Professor	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", internal phone: 73-61	
Employers:				
Amiret T. Konuspaev	Candidate of Physical and Mathematical Sciences	President	Association of Innovative Companies of the Special Economic Zone "Park of Innovative Technologies"	
Orken Zh. Mamyrbayev	PhD, Associate Professor	Deputy General Director	RSE "Institute of Information and Computing Technologies"	
Students				
Atkeldy Ogan		1st year doctoral student	NCJS "Kazakh National Research Technical University named after K.I.Satpayev", mobile phone:+77076665721	

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List of abbreviations and designations

EP – educational program
BC – basic competencies
PC – professional competencies
LO – learning outcomes
MOOC – massive open online courses
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework

1. Description of educational program

The educational programs of the Master's degree are structured according to the principle of modular training. The structure of the Master's degree program is formed from various types of educational and scientific work that determine the content of education. The Master's degree program contains:

1) theoretical training, including the study of cycles of basic and core disciplines;

2) practical training of undergraduates: various types of practices (pedagogical and research), professional internships;

3) research work of master's student (RWMS), including the implementation of a master's thesis – for scientific and pedagogical magistracy;

4) intermediate and final attestations (FA).

2. Purpose and objectives of educational program

Purpose of EP: Training of highly qualified specialists in the field of information management using modern information and communication technologies for all spheres of the national economy of Kazakhstan, capable of solving the problems of effective management of both the elements, processes and resources of the information system itself, and other elements, processes and resources of the enterprise and organizations.

Tasks of EP:

1. Setting goals and objectives of the designed information systems based on the analysis of the information needs of the organization.

2. The choice of modern technology for the design and development of IT solutions.

3. Apply effective principles of IT resource management.

4. Use mathematical methods to model the business processes of the organization, and develop algorithms for their implementation in information systems.

5. Develop IP applications and algorithms for the functioning of IP modules based on domain analysis.

6. To carry out scientific and pedagogical activities, to participate in the development of educational and methodological materials for teaching in colleges and universities of disciplines in the direction of "Information and communication technologies".

3. Requirements for evaluating the educational program learning outcomes

The educational program was developed in accordance with the State mandatory Standards of higher and Postgraduate Education, approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of

Regulatory Legal Acts under No. 28916) and reflects the learning outcomes on the basis of which curricula are developed (working curricula, individual curricula of students) and working curricula in disciplines (syllabuses). Mastering disciplines of at least 10% of the total volume of credits of the educational program using MOOC on the official platform https://polytechonline.kz/cabinet/login/index.php /, as well as through the study of disciplines through the international educational platform Coursera https://www.coursera.org /.

Evaluation of learning outcomes is carried out according to the developed test tasks within the educational program in accordance with the requirements of the state mandatory standard of higher and postgraduate education.

When evaluating learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate their knowledge, skills and abilities.

When conducting an interim certification in an online form, online proctoring is used.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M06 «Information and communication technologies»
2	Code and classification of training directions	7M061 «Information and communication technologies»
3	Educational program group	M094 « Information technologies»
4	Educational program name	7M06103 «Management of information systems»
5	Short description of educational program	The program describes and regulates the procedure for training highly qualified specialists in the field of information management using modern information and communication technologies for all spheres of the national economy of Kazakhstan, capable of solving the tasks of effective management of both elements, processes and resources of the information system itself and other elements, processes and resources of the enterprise. The main functions of the professional activity of masters in the direction of "Information and communication technologies" are: design, development, analysis, testing, implementation of information systems for various purposes and their components, information management with the use of modern technologies.
6	Purpose of EP	Training of highly qualified specialists in the field of information management using modern information and communication technologies for all spheres of the national economy of Kazakhstan, capable of solving the problems of effective management of both the elements, processes and resources of the information system itself, and other elements, processes and resources of the enterprise and organizations.

7	Type of EP	New EP
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	No
11	List of competencies of educational program	Requirements for the key competencies of graduates of the scientific and pedagogical Master's degree should: 1) have an idea: - on the role of science and education in public life; - about current trends in the development of scientific knowledge; - about actual methodological and philosophical problems of natural (social, humanitarian, economic) sciences; - about the professional competence of a high school teacher; - about contradictions and socio-economic consequences of globalization processes. 2) know: - methodology of scientific cognition; - principles and structure of the organization of scientific activity; - psychology of cognitive activity of undergraduates in the learning process; - psychological methods and means of improving the effectiveness and quality of training. 3) be able to: - use the acquired knowledge for the original development and application of ideas in the context of scientific research; - critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena; - integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions; - by integrating knowledge to make judgments and make decisions based on incomplete or limited information; - apply the knowledge of pedagogy and psychology of higher education in their teaching activities; - apply interactive teaching methods; - to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies; - think creatively and creatively approach the solution of new problems and situations; - be fluent in a foreign language at a professional level that allows conducting scientific research and teaching special disciplines in universities; - summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc. 4) have the skills of: - research activities, solving standard scientific problems;

		- implementation of educational and pedagogical activities on credit technology of training; - methods of teaching professional disciplines; - the use of modern information technologies in the educational process; - professional communication and intercultural communication; - oratory, correct and logical formalization of their thoughts in oral and written form; - expansion and deepening of knowledge necessary for daily professional activity and continuing education in doctoral studies. 5) be competent: - in the field of research methodology; - in the field of scientific and scientific-pedagogical activity in higher educational institutions; - in matters of modern educational technologies; - in the implementation of scientific projects and research in the professional field; - in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.
12	Learning outcomes of educational program	ON1. To have an idea of the current methodological and philosophical problems of the natural sciences and the professional competence of a higher school teacher. ON2. Know the methodology of scientific knowledge and the principles and structure of the organization of scientific activity. ON3. Be able to critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena. Be fluent in a foreign language at a professional level that allows for scientific research. ON4. Demonstrate competence in the implementation of scientific projects and research in the professional field. Apply knowledge, expanding professional skills and abilities. ON5. Apply the methodology, models, methods, tools for the development and design of information systems to solve professional problems ON6. Apply project management in IT. ON7. Разрабатывать научно-исследовательские проекты. Принимать решения на основе системного анализа и синтеза информационных систем. ON8. Perform knowledge processing in expert systems, apply artificial intelligence methods. Design intelligent systems. ON9. Design an information model of the subject area, use multi-user database administration methods, use modern DBMS to process databases. ON10. Apply the basic principles of big data technology in enterprise architecture and the basic methods of analytical processing of big data. ON11. Analyze the benefits of cloud technologies in

		modern business to solve professional problems, apply the tools of this technology.
13	Education form	Full-time, online
14	Period of training	2 years
15	Amount of credits	120
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Master of Technical Sciences
18	Developer(s) and authors	R.Satybaldieva, E.Aitkhozhaeva

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)										
				ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11
Cycle of basic disciplines University component														
1	Foreign language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies.	5	v		v								
2	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3	v	v									
3	Higher school pedagogy	Undergraduates will master the methodological and theoretical foundations of higher school pedagogy, plan and organize the processes of teaching and upbringing, master the communicative technologies of subject-subject interaction between a teacher and a master in the educational process of a university.	3	v	v		v							
4	Psychology of management	The discipline studies the modern role and content of psychological aspects in managerial activity. The improvement of the psychological literacy of the student in the process of implementing professional	3						v	v				

		activities is considered. Self-improvement in the field of psychology and studying the composition and structure of management activities, both at the local level and abroad. The psychological feature of modern managers is considered.												
5	Pedagogical practice	It is aimed at the formation of practical skills and teaching methods. Pedagogical practice can be carried out during the period of theoretical training without interrupting the educational process. At the same time, undergraduates can be involved in conducting classes in the bachelor's degree.	6	v			v							
Cycle of basic disciplines Component of choice														
6	Analysis and modeling of information systems	The course is aimed at studying the principles and methods of modeling random parameters and processes of complex systems, and analyzing their functioning. In the process of studying the discipline, undergraduates will get acquainted with modern methods of analyzing information systems and processes, the apparatus for simulating random and non-stationary parameters of complex systems, learn how to use intelligent simulation tools, computer modeling technology. The issues of organization of computational experiments and the use of object-oriented analysis and modeling of information processes are also considered.	5					v						
7	Security of Virtualization and Cloud Systems	In the process of studying the course, security issues of cloud technologies, sources of threats in cloud computing will be considered. Will be studied: cloud deployment models: public, private, hybrid clouds; cloud technology models; features and characteristics of cloud computing; information security standards in the field of cloud technologies and virtualization systems; means of ensuring the	5										v	v

		protection of cloud computing; encryption; VPN networks; authentication; user isolation.												
8	Artificial intelligence methods	The course is a comprehensive study of a class of machine learning algorithms, such as convolutional, recurrent, and recursive neural networks. Within the framework of the discipline, the methods of artificial intelligence, the principles of organization and use of intelligent information technologies are considered.	5								v		v	
9	Methods of computer simulation	The course is devoted to computer modeling methods in production, logistics, organizational, economic and financial systems, taking into account instabilities and conflict situations. In the course, students: study the issues of modeling parameters and processes with given or predictable patterns of their values; learn to apply typical schemes for modeling processes occurring in various systems; learn the skills of conducting a computational experiment.	5							v				
10	Database development in Microsoft SQL Server environment	The course content includes client / server database technologies, methods of creating multi-user databases and its objects, query optimization, technologies for storing and analyzing corporate data, models of analytical data processing in a DBMS.	5					v				v		
11	Web Mining	The course is aimed at developing theoretical knowledge and practical skills for undergraduates to analyze data received from the Internet and interpret the results. The course examines the main methods of data analysis used to work with Internet data, including all stages: initial, preprocessing, modeling, model analysis. Work in the R environment with packages for analyzing Internet	5								v		v	v

		data. Using Data Mining Algorithm Methods to Search for User Behavior Patterns												
Cycle of profile disciplines University component														
12	The architecture of information systems	The aim of the course is to master and systematize theoretical knowledge in the field of modern information systems (IS) architectures. The content of the discipline includes the classification of IP architecture, principles of IP construction, models and resources of information systems, the main components of information systems. During the course, students will use information system architecture development tools and information system development tools.	5					v					v	v
13	Methodology of scientific research and innovation	The purpose of mastering the course is to develop the student's skills in conducting research activities. The content of the discipline includes questions of determining the direction of research; goals and objectives of the study; stages of writing a scientific publication, literary review; organization of a scientific experiment; directions of innovative activity; the role of scientific research in innovation.	5		v	v	v	v			v			
14	Research practice	The research practice of the undergraduate is conducted in order to familiarize himself with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.	8		v		v	v						
Cycle of profile disciplines Component of choice														
15	Geographic information systems	The purpose of studying the discipline is to familiarize undergraduates with existing Geoinformation systems (GIS), teaching the typical structure of modern Geoinformation systems and its	5					v					v	v

		functionality. The course content includes the following: principles and functions of GIS; components (components) of GIS; data structure in GIS; design of information systems using GIS technology												
16	Intellectual methods of data processing	The course is aimed at developing undergraduates a set of theoretical knowledge and methodological foundations in the field of data mining and data processing methods, as well as practical skills necessary for the introduction and practical use of intelligent algorithms for data analysis and processing. In the process of mastering the discipline, the student learns to independently perform experimental research to solve research and production tasks.	5		v	v	v	v			v			
17	Methods and tools for building information retrieval systems	The discipline studies the methods and principles of building information retrieval systems (IPS) and their practical application. The presentation of information in IPS, the principles of text analysis and document indexing, typical models (boolean and vector) and information retrieval algorithms are considered. Basic information about the classification of documents is given. The course examines modern vocabulary, classification and metasearch IPS, their practical application and performance criteria.	8		v		v	v						
18	Methods of modeling business processes	The course is aimed at developing students' skills in modeling and analyzing business processes in order to solve applied problems. The content of the discipline includes questions about a systematic, process-oriented approach to business management, methodologies and models, tools for modeling and analyzing business processes and managing complex systems. In the course of studying the	5		v			v					v	

		discipline, undergraduates use modern tools for modeling and analyzing business processes.												
19	Models and mechods of decision-making in IP	The purpose of teaching the discipline is to study models and methods used in decision support systems, as well as in the development of modern computer information systems. The content of the discipline includes mathematical methods of operation research, methods for solving nonlinear problems of unconditional optimization, methods for solving nonlinear problems of conditional optimization, application of methods and methodology of operation management in the development of computer systems for information processing and management	5					v		v	v			
20	Applied statistics and data analysis	Applied statistics - methodological discipline, which is the center of statistics. When applying applied statistics methods to specific areas of knowledge and branches of the national economy, scientific and practical disciplines such as "statistics in industry", "statistics in medicine", "statistics in psychology," etc. are obtained. From this point of view, econometrics is "statistical methods in economy ". Mathematical statistics plays the role of a mathematical foundation for applied statistics.	5				v	v			v		v	
21	Theory and practice of statistics	The aim of the course is to study the possibilities of algorithmic support of systems designed for data analysis and interpretation. The discipline considers methods of data analysis and further interpretation of the results. Considerable attention is paid to the issues of data classification using deterministic and statistical models. Methods for reducing data dimensions are considered. New methods of data analysis based on Data Mining technology are being studied. Modern packages of applied programs for	5					v			v		v	

		solving problems of processing experimental data are analyzed.												
22	Big Data and Data Analysis	The purpose of the course is to form students' professional competence in the development and use of systems for processing and analyzing large amounts of data. The content of the discipline examines the methods of analysis and storage of large amounts of data, the stages of the life cycle of big data processing, the languages best suited for processing and analytics of big data, ways of organizing storage and access to big data.	5								v		v	v
23	Business Intelligence	The course is aimed at forming a set of theoretical knowledge and practical skills of applying modern information tools of business analytics for business management among undergraduates. During the practical lesson, undergraduates master the skills of working in the most popular business intelligence platforms: Power BI, Qlik Sense, Tableau for decision support in marketing and business management; OLAP (online analytical processing) skills in solving analytical tasks: exploratory analysis, data research, analytical reporting formation.	5								v		v	v
24	Cloud computing	The course will provide you with the competencies necessary to work with cloud systems with different settings. The course content considers the following issues: collection, visualization, data storage, their security and automation; design and deployment of a cloud storage system; developing the most convenient and effective strategy for migrating legacy systems to the cloud; development of testing methods for evaluating the effectiveness of corporate cloud systems in order to make recommendations for their improvement.	5										v	v

25	Data mining	Data mining is an interdisciplinary discipline that studies the analysis and processing of data of various structures and volumes. Data mining methods are important in the research and development of information systems that solve data analytics tasks, forecasting various indicators in various fields of human activity. In this discipline, students study both visual and analytical methods to determine the structure of data. Methods are studied: descriptive, cluster, variance, regression analysis of data and other parametric and nonparametric methods. In the study, students use both software packages and special programming languages.	5									v	v	v
26	IT management	The purpose of mastering the course is to study the concept, goals and objectives of information management. Issues covered in the course: enterprise architecture and its management; concepts, methodologies and standards of corporate governance; methodologies and standards for information technology management; trends and prospects for the development of information management. As a result of mastering the discipline, undergraduates will be able to apply the management methodology in IT projects	5				v	v	v					
27	Machine Learning & Deep Learning	The course focuses on deep learning models. As a field within machine learning, deep learning models exemplify the quantitative-qualitative transition. New models and their properties require a separate study and practice of setting the metaparameters of such models. This course covers deep learning fundamentals, neural networks, convolutional networks, RNN, LSTM, Adam, Dropout, BatchNorm, Xavier/He initializations.	5							v	v			

28	OLAP and Data Warehousing	The purpose of mastering the discipline is to obtain in-depth knowledge of data storage systems and data mining and data processing technologies. The content of the discipline includes questions on the types of data models, the concept and architecture of data warehouses, the implementation of procedures and examples of modern corporate systems using OLAP technology. Upon completion of the course, undergraduates will be able to design data warehouses and apply data processing technologies to solve research problems.	5								v		v	v
Research work of a master's student														
29	Research work of a master's student, including internship and completion of a master's thesis	Systematization of theoretical knowledge, development of skills for setting tasks on the topic of research and their consistent solution. Research work includes evaluation of research objects, describing its problems, highlighting a narrow area for research, conducting an experiment, analyzing the results of the experimental part, preparing and defending a research report and summarizing the results.	24		v		v	v						

5. Curriculum of educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I.SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Board - Rector
M.T.Ragentayev
«__» _____ 2022 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year
Educational program 7M06103 "Management of Information Systems"
Group of educational programs M094 "Information technologies"

Form of study: full-time **Duration of training:** 2 years **Academic degree:** master of Technical Sciences

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lek/lab/pr	SIS (including TSIS) in hours	Form of control	Distribution of classroom classes by courses and semesters			
								I course		2 course	
								1 semester	2 semester	3 semester	4 semester
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Basic training module (university component and component of choice)											
LNG210	Foreign language (professional)	BD, UC	5	150	0/0/3	105	E	5			
HUM214	Psychology of management	BD, UC	3	90	1/0/1	60	E	3			
HUM212	History and philosophy of science	BD, UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD, UC	3	90	1/0/1	60	E		3		
CSE768	Analysis and modeling of information systems	BD, CCH	5	150	1/0/2	105	E	5			
SEC249	Methods of computer simulation				2/0/1						
SEC241	Database development in Microsoft SQL Server	BD, CCH	5	150	2/0/1	105	E		5		
SEC 244	Security of Virtualization and Cloud Systems				2/0/1						
CSE773	Artificial intelligence methods	BD, CCH	5	150	2/0/1	105	E		5		
CSE774	Web Mining				2/0/1						
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Professional training module (university component and component of choice)											
CSE770	Methodology of scientific research and innovation	PD, UC	5	150	2/0/1	105	E	5			
CSE203	The architecture of information systems	PD, UC	5	150	1/1/1	105	E	5			
CSE767	Data mining	PD, CCH	5	150	2/0/1	105	E		5		
CSE207	Methods of modeling business processes				2/0/1						
CSE765	IT management	PD, CCH	5	150	2/0/1	105	E		5		
SEC232	Business Intelligence				2/0/1						
SEC246	Big Data and Data Analysis	PD, CCH	5	150	2/1/0	105	E			5	
CSE746	Machine Learning & Deep Learning				2/0/1						
CSE764	Cloud computing	PD, CCH	5	150	2/0/1	105	E			5	
SEC234	OLAP and Data Warehousing				1/1/1						
CSE 219	Theory and practice of statistics	PD, CCH	5	150	1/1/1	105	E			5	
SEC230	Applied statistics and data analysis				1/0/2						
M-3. Module of scientific research, data analysis and modeling (component of choice)											
CSE211	Models and mechods of decision-making in IP	PD, CCH	5	150	1/1/1	105	E			5	
CSE769	Methods and tools for building information retrieval systems				2/0/1						
M-4. Data management and processing module in IS (component of choice)											
SEC243	Intellectual methods of data processing	PD, CCH	5	150	1/1/1	105	E			5	

CSE205	Geographic information systems				1/1/1						
M-5. Practice-oriented module											
AAP229	Pedagogical practice	BD, UC	6						6		
AAP269	Research practice	PD, UC	8								8
M-6. Research module											
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS	2					2			
AAP241	Research work of a master's student, including internship and completion of a master's thesis	RWMS	3						3		
AAP254	Research work of a master's student, including internship and completion of a master's thesis	RWMS	5							5	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS	14								14
M-7. Module of final attestation											
ECA213	Preparation and defense of a master's thesis	PDMT	8								8
	Total by UNIVERSITY:							25	35	30	30
								60		**60**	

Number of credits for the entire period of study				
Cycle code	**Cycles of disciplines**	**Credits**		
		university component (UC)	**component of choice (CCH)**	**Total**
BD	Cycle of basic disciplines	20	15	35
PD	Cycle of profile disciplines	18	35	53
	Total for theoretical training:	***38***	***50***	***88***
RWMS	Research work of a master's student	24		24
PDMT	Preparation and defense of a master's thesis	8		8
	Total:	**70**	**50**	**120**

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 3 "27" october 2022 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 2 "21" october 2022 y.

Decision of the Academic Council of the Institute Automation and Information Technologies
Protocol № 2 "21" september 2022 y.

Governing Board member - Vice-Rector for Academic Affairs _____ **B.A.Zhautikov**

Institute Director Automation and Information Technology _____ **R.K.Uskenbayeva**

Department Head "Cybersecurity, information processing and storage" _____ **R.Zh.Satybaldieva**

Representative of the Council from employers _____ **V.V.Pokusov**