



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

EDUCATIONAL PROGRAM
7M06302 "Comprehensive information security"

Code and classification of the field of education: **7M06 "Information and communication technologies"**

Code and classification of training directions **7M063 "Information security"**

Group of educational programs: **M095 "IT security"**

Level based on NQF: **7**

Level based on IQF: **7**

Study period: **1,5 years**

Amount of credits: **90**

Almaty 2023

Educational program 7M06302 «Comprehensive information security» 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 7M06302 «Comprehensive information security» was developed by Academic committee based on direction 7M063 «Information security».

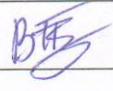

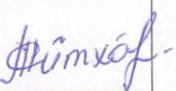






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Table of contents

	List of abbreviations and designations	4
1	Description of educational program	5
2	Purpose and objectives of educational program	5
3	Requirements for the evaluation of educational program learning outcomes	6
4	Passport of educational program	7
4.1	General information	7
4.2	Relationship between the achievability of the formed learning outcomes according to educational program and academic disciplines	11
5	Curriculum of educational program	19

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
IS – information security
ICT – Information and communication technologies
IT – information Technology

1. Description of educational program

The educational program 7M06302 “Comprehensive information security” is aimed at training master’s students in a specialized field. The program includes basic and specialized disciplines with the achievement of relevant competencies, as well as various types of internships (production practice, experimental research and internship).

The professional activities of masters are aimed at the field of information protection and security, namely the comprehensive provision of information security and engineering and technical protection of information.

Training of specialized masters in information security will be carried out according to the updated educational program 7M06302 “Comprehensive information security”. The programs of disciplines and modules of the educational program are interdisciplinary and multidisciplinary in nature, developed taking into account the relevant educational programs of the world's leading universities and the international classifier of professional activities in the field of information security.

The educational program ensures the application of an individual approach to students, the transformation of professional competencies from professional standards and qualification standards into learning outcomes and ways to achieve them.

The educational program was developed based on an analysis of the labor functions of an information security administrator, information security auditor, and information security engineer, as stated in professional standards.

The main criterion for completing studies in master's programs is the mastery of all types of educational and professional activities of the master's student.

Upon successful completion of the full course, the student is awarded a Master of Engineering and Technology degree in the educational program 7M06302 “Comprehensive information security.”

A graduate can perform the following types of work:

- design and engineering;
- production and technological;
- experimental research;
- organizational and managerial;
- operational.

Representatives of Kazakh companies and associations, specialists from departmental structures in the field of protection and security participated in the development of the educational program.

2. Purpose and objectives of educational program

Purpose of EP: Training of specialists for professional activities in the field of information security, who are able to apply various technologies, knowledge, skills and competencies in the organization, management and design of information security systems.

Tasks of EP: Training of highly qualified specialists who can solve the

following tasks:

- planning work on information security audit;
- organizational support for IS audit;
- carrying out an analysis of the compliance of design, operational and technical documentation on information security with the requirements in the field of ICT and information security support for the object of the information security audit;
- analysis of the current state of security of the IS audit object;
- identification and elimination of vulnerabilities;
- monitoring and investigating information security incidents;
- development of a model of threats to information security in enterprises;
- development of technical specifications for the creation of an information security system.

The master's degree in educational program 7M06302 "Comprehensive information security" is focused on independently determining the goals of professional activity and choosing adequate methods and means to achieve them, carrying out innovative activities to obtain new knowledge. In addition, it is focused on the organization, design, development, management and audit of applied information protection and security systems for all sectors of the economy, government organizations and other areas of activity.

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	7M063 «Information security»
3	Educational program group	M094 «IT security»
4	Educational program name	7M06302 «Comprehensive information security»
5	Short description of educational program	<p>Professional activities of graduates include: education, government and departmental structures, economics and industry of the state, and healthcare.</p> <p>The objects of professional activity of graduates of master's programs in the educational program 7M06302 “Comprehensive information security” are:</p> <ul style="list-style-type: none"> – government bodies; – information security departments and departments of departmental organizations; – information security departments, IT departments and departments of financial organizations; – information security departments, IT departments and departments of industrial enterprises; – departments and departments of information security of government organizations and commercial structures. <p>The main functions of the professional activities of undergraduates are: conducting research in the field of information protection and security; audit, vulnerability analysis and incident investigation in information security systems; design, implementation, operation, administration, maintenance and testing of enterprise information security systems.</p> <p>Areas of professional activity are the following:</p> <ul style="list-style-type: none"> – design, development, implementation and operation of information security systems; – analysis, testing and identification of system vulnerabilities; – information security audit.
6	Purpose of EP	Training of specialists for professional activities in the field of information security, who are able to apply various technologies, knowledge, skills and competencies in the organization, management and design of information security systems
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	<p>A graduate of a specialized master's program must:</p> <ol style="list-style-type: none"> 1) have an idea: <ul style="list-style-type: none"> – about the contradictions and socio-economic

	<p>consequences of globalization processes;</p> <ul style="list-style-type: none"> – about professional competence in the field of information protection and security; – about the technology of virtualization of resources and platforms; – on the intellectualization of information security means; - about database protection technologies; – about algorithms for cryptographic information protection; - about big data analysis. <p>2) know:</p> <ul style="list-style-type: none"> – psychological methods and means of increasing the effectiveness and quality of training; – algorithms for cryptographic information protection; – IS standards and IT security assessment criteria; - technologies for virtualization of resources and platforms and virtualization systems from leading manufacturers; - threats and risks of virtualization systems, principles of constructing hypervisors and their vulnerabilities; – organization of IP networks, structure of IP packets and IP protocols; – internal organization of OS storage media; – methods and means of storing key information and encryption; - types and principles of authentication; – requirements for firewalls and intrusion detection systems; - database protection technologies and methods for designing secure databases; - organization of the database protection and security system; – active audit methods and tools; – engineering and technical protection of information. <p>3) be able to:</p> <ul style="list-style-type: none"> - critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena; - integrate knowledge gained within different disciplines to solve research problems in new unfamiliar conditions; – through the integration of knowledge, make judgments and make decisions based on incomplete or limited information; – carry out information-analytical and information-bibliographic work using modern information technologies; - think creatively and have a creative approach to solving new problems and situations; – be fluent in a foreign language at a professional level, allowing you to conduct research; – summarize the results of analytical work in the form of a dissertation, article, report, analytical note, etc.;
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		<ul style="list-style-type: none"> – apply cryptographic information protection algorithms; - apply information security standards and conduct IT security assessments; - use virtualization systems from leading manufacturers; - identify threats and risks of virtualization systems; – apply methods and means of storing key information and encryption; – work with firewalls and intrusion detection systems; – apply database protection technologies and methods for designing secure databases; – organize a database protection and security system; – apply active audit methods and tools; - apply big data analysis tools. <p>4) have the skills:</p> <ul style="list-style-type: none"> – professional communication and intercultural communication; – organization and protection of database security; – conducting an information security audit; – application of cryptographic information protection algorithms; – identifying threats and countering them; – working with Big Data; – expanding and deepening the knowledge necessary for everyday professional activities. <p>5) be competent:</p> <ul style="list-style-type: none"> – in the organization of information security systems; – conducting an information security audit; – in ensuring the information security of the organization; – in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.
12	Learning outcomes of educational program	<p>ON1. To be able to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities. Apply in practice the knowledge of fundamental and applied sections of the disciplines that determine the direction (profile) of the master's program</p> <p>ON2. Be competent in cybercrime detection and computer forensics. Be able to use the means of recognizing and counteracting cyber attacks. Know the technical means and methods of technical information protection, be competent in the organization of engineering and technical information protection.</p> <p>ON3. Be able to apply various decision support methods, quickly control the execution of work, resolve conflicts between team members, manage risks arising from the implementation of projects. Know modern standards in the field of project management and their characteristics. Proficiency in foreign languages.</p> <p>ON4. Be able to use regulatory documents in practice when planning and organizing research and production</p>

		<p>work in the field of information security. To know modern and perspective directions of development of cryptographic protection of information and apply it in practice.</p> <p>ON5. Know and apply resource and platform virtualization technologies and virtualization systems from leading manufacturers. Know the threats and risks of virtualization systems, the principles of building hypervisors and their vulnerabilities.</p> <p>ON6. Know the organization of IP networks, the structure of IP packets and IP protocols, the types and principles of authentication. Be able to assess the security of network operating systems</p> <p>ON7. Be able to organize the system of protection and security of the database. Apply database security technologies and secure database design methods.</p> <p>ON8. Be able to analyze big data, know the methods and tools for analyzing big data. Ability to formulate problems, tasks and methods of scientific research.</p>
13	Education form	Full-time, online
14	Period of training	1,5 years
15	Amount of credits	90
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Master of Engineering and Technology
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
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. The course ends with a final exam. Undergraduates also need to study independently (MIS).	2			v					
2	Management	The purpose of the discipline is the formation of a scientific understanding of management as a form of professional activity; mastering the general theoretical provisions of the management of socio-economic systems by students; mastering the skills and abilities of practical solution of managerial problems; studying the world experience of management, as well as the peculiarities of Kazakhstani management, training in solving practical issues related to the management of various aspects of the activities of organizations.	2			v					
3	Psychology of management (MOOC)	The course is aimed at mastering the tools for effective employee management, based on knowledge of the psychological mechanisms of the manager's activity. Discipline will help you master the skills of making decisions, creating a favorable psychological climate, motivating employees, setting goals, building a team and communicating with employees. At the end of the course, undergraduates will learn how to resolve	2			v					

		managerial conflicts, create their own image, analyze situations in the field of managerial activity, as well as negotiate, be stress-resistant and effective leaders.									
Cycle of basic disciplines Component of choice											
4	Algorithms for cryptographic protection of information	The modern cryptography and tasks connected to information security problems. The formal determination of the cryptosystem. Classical cryptosystems. Main objectives of crypto-analysis. Stream encryption. Cryptosystems with public key. Applications of mathematical simulation in cryptography. Merits and demerits of different systems. Euler and Fermat's theorems. Key management. System without transmission of a key. Problem of prime factorization. Problem of the discrete logarithm. Cryptofirmness problem. Systems of information security, diagram of the digital signature, authentication protocols and identifications.	4	v			v				
5	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 protection of cloud computing; encryption; VPN networks; authentication; user isolation.	5					v	v		
6	Cryptographic methods and means of information protection	Master's degree. Modern cryptography and tasks related to information security problems. Formal definition of a cryptosystem. classical cryptosystems. The main tasks of cryptanalysis. Stream encryption. Cryptosystems with a public key. Applications of mathematical modeling in cryptography. Advantages and	4	v			v				

		disadvantages of various systems. Euler's and Fermat's theorems. Key management, Keyless system. The problem of decomposition into prime factors. Discrete logarithm problem. The problem of cryptographic strength. Information security systems, electronic signature schemes, authentication and identification protocols.									
7	Scientific Python	The course studies the general principles of working with data: loading, receiving and processing unstructured data, obtaining data through the API, visualizing and publishing data, filtering, transforming, analyzing and interpreting data using well-known models of classification, clustering, regression, etc. The range of tasks covers methods optimization, stochastic modeling, Gaussian modeling, partial differential equations, Navier-Stokes equation, heat equations.	5					v	v		
Cycle of profile disciplines University component											
8	Organization of information security systems	The concept of information security systems. Information security systems standards. Select an object to organize the system. Threat analysis and security software development. Administrative and procedural levels of information security. Analysis and selection of information security methods. Provision and evaluation of objects	5	v		v					v
9	Production practice I	The production practice is aimed at strengthening knowledge and developing practical experience in the field of information security. The objectives of the practice include the participation of undergraduates in the organization of computer information protection, network technology, organization of computer systems and networks. The practice is aimed at the ability to independently carry out production, laboratory and interpretation work when solving practical problems.	5	v	v		v				

10	Production practice II	The production practice is aimed at strengthening knowledge and developing practical experience in the field of information security. The practice is aimed at the ability to use modern methods of processing and interpreting complex information to solve production problems.	4	v	v		v				
Cycle of profile disciplines Component of choice											
11	Data analysis and Data retrieval	The discipline is aimed to teach information retrieval and data mining techniques. It is about how to find relevant information and subsequently extract meaningful patterns out of it. While the basic theories and mathematical models of information retrieval and data mining are covered, the discipline is primarily focused on practical algorithms of textual document indexing, relevance ranking, web usage mining, text analytics, as well as their performance evaluations. Practical retrieval and data mining applications such as web search engines, personalisation and recommender systems, business intelligence, and fraud detection will also be covered.	5	v						v	v
12	Information Security Audit	Audit of information security. Basic terms, definitions, concepts and principles in the field of information security audit. The main directions of the audit of information security. Types and objectives of the audit. The main stages of the security audit. A list of the initial data required to conduct a security audit. Assessment of the current state of the information security system. Assessment of the level of safety. Risk analysis, assessment of the level of security, development of security policies and other organizational and administrative documents for the protection of information. Effective programs to build an organization's security system	5		v		v				

13	Technical protection of information	Magistracy. Technical Protection (TP) of information. Actions for information security using passive and active technical means. Information ITZ technical means, classification. Physical security features of objects. Hardware of search and detection of channels of information leakage. Technical channels of leakage of acoustic information. Technical means of reception and information transfer. Mortgage devices of interception of the voice information. Telephone ear. Electronic stethoscopes. Laser microphones. Optical-electronic interception of audible tones by laser probing of windowpanes. The technical channel of information leakage by "high-frequency imposing". The parametric technical channels of information leakage.	5	v	v						
14	Intellectualized recognition and countermeasures for cyber attacks	Models, targets, tools of cyber attacks. Active protection as a method of countering advanced cyber threats. Effective counteraction. Components of active protection. Preventive network research. Analysis of anomalies. Advantages of active protection	5					v	v		
15	Information security of economic systems	Economic information as a commodity and a security object. Economic activity in the Internet. Types of security threats in economic information systems. Security policy. The main ways of unauthorized access to information. Methods and means of protection used in economic systems, their classification. Hardware security. Means of detecting information leakage channels. Firewalls. Intrusion detection systems. DLP-system. Malicious programs. Systems of data backup and recovery. Cryptographic tools. Database protection. Cloud technology and data security.	5				v			v	v
16	Cybercrime and computer forensics	The course is aimed at the study of digital evidence, methods of searching, obtaining and fixing such evidence, as well as the analysis and investigation of events in which computer information or a computer as	5		v		v		v		

		a tool for committing a crime or other digital evidence appears. The course explores typical models of cybercriminals and their behavior, the main types of cyberattacks, as well as methods for responding, investigating and documenting cyber incidents.									
17	Organization of protection and safety of a database	Aspects and criteria of security, security policy. Data security threats. Database protection and security, data integrity and reliability. Methods and means of protection and data protection. Develop a secure database. CASE design tools. Database administration tools. Impressions as tools to improve data security. Effect of cursors on database security. Transaction management. stored procedures. triggers. Mandatory and discretionary access control to the DBMS. Role and reports. Monitoring and audit of DBMS. Cryptographic tools for database protection. Replication and data recovery. High training tools.	5	v						v	
18	Risk management in cyber security	The program of the training course "Risk Management in Cybersecurity" is aimed at studying international and national standards for risk management in cybersecurity, methods for determining and managing risks, the practical application of standards and methods, studying specialized software systems for risk assessment.	5				v				v
19	Steganographic methods of information protection	The content of the discipline covers a range of issues related to the protection of information through mathematical transformations using steganographic algorithms and copyright protection algorithms.	5	v			v				
20	Technologies of protection of wireless networks (applications)	Magistracy. Security technology for wireless networks and mobile applications. Unified solutions. Classification of applications for mobile devices. Methods for scanning and testing mobile applications. Integrated security system for wireless networks. Analysis of the security of mobile applications. Analysis of the security of mobile applications. Threats and	5					v	v		

		security risks of wireless networks and mobile applications. Security protocols of wireless networks. WEP encryption mechanism. Passive and active network attacks. Authentication in wireless networks and mobile applications. Integrity and confidentiality of transmitted data. Deploying wireless virtual networks. Tunneling. IPSec protocol. Intrusion detection systems in wireless networks and mobile applications, their characteristics.									
21	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
22	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
23	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	5							v	v

		and apply data processing technologies to solve research problems.										
24	Security Internet of things	The purpose of mastering the course is to study the main areas of activity to ensure the security of the Internet of things, cyber-physical systems as part of critical information infrastructure facilities. As a result of mastering the discipline, undergraduates will learn to use the principles of a systematic approach; ways of forming requirements for the cybersecurity of the Internet of Things systems; the main provisions of the standards for the functional safety of process control systems ("Industrial Internet of things"); requirements of regulatory legal acts and standards for the development of information security threat models.	5		v							
Experimental research work of a master's student												
25	Experimental research work of a master student, including an internship and the implementation of a master's project	Systematization of theoretical knowledge, development of skills in setting problems on the research topic and solving them consistently. Research work includes assessing the objects of research, describing its problems, identifying a narrow area for research work, conducting an experiment, analyzing the results of the experimental part, preparing and defending a report on the EIR and summing up the results.	18	v	v	v	v					

5. Curriculum of educational program

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CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year
Educational program 7M06302 "Comprehensive information security"
Group of educational programs M095 "IT Security"

Form of study: full-time Duration of training: 1,5 years Academic degree: Master of Engineering and Technology

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		
								1 course		2 course
								1 semester	2 semester	3 semester
CYCLE OF BASIC DISCIPLINES (BD)										
M-1. Module of basic training (university component and component of choice)										
LNG212	Foreign language (professional)	BD, UC	2	60	0/0/2	30	E	2		
MNG726	Management	BD, UC	2	60	1/0/1	30	E	2		
HUM211	Psychology of management	BD, UC	2	60	1/0/1	30	E	2		
CSE778	Algorithms for cryptographic protection of information	BD, CCH	4	120	2/0/1	75	E	4		
CSE779	Cryptographic methods and means of information protection				2/0/1					
SEC244	Security of Virtualization and Cloud Systems	BD, CCH	5	150	2/0/1	105	E	5		
CSE738	Scientific Python				1/0/2					
CYCLE OF PROFILE DISCIPLINES (PD)										
M-2. Module of professional activity (university component and component of choice)										
SEC215	Organization of information security systems	PD, UC	5	150	1/1/1	105	E	5		
SEC246	Big Data and Data Analysis	PD, CCH	5	150	2/1/0	105	E	5		
CSE746	Machine Learning & Deep Learning				2/0/1					
SEC248	Security Internet of things	PD, CCH	5	150	1/0/2	105	E	5		
SEC222	Technologies of protection of wireless networks (applications)				1/0/2					
SEC214	Organization of protection and safety of a database	PD, CCH	5	150	2/0/1	105	E		5	
SEC209	Information security of economic systems				2/0/1					
SEC204	Information Security Audit	PD, CCH	5	150	2/0/1	105	E		5	
SEC245	Risk management in cyber security				2/0/1					
SEC234	OLAP and Data Warehousing	PD, CCH	5	150	1/1/1	105	E		5	
CSE258	Data analysis and Data retrieval				1/1/1					
CSE718	Technical protection of information	PD, CCH	5	150	1/0/2	105	E		5	
SEC238	Steganographic methods of information protection				1/0/2					
SEC240	Cybercrime and computer forensics	PD, CCH	5	150	2/0/1	105	E		5	
SEC247	Intellectualized recognition and countermeasures for cyber attacks				2/0/1					
M-3. Practice-oriented module										
CSE782	Production practice I	PD, UC	5						5	

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CSE783	Production practice II	PD, UC	4							4
M-4. Experimental research module										
AAP249	Experimental research work of a master's student, including internship and implementation of a master's project	ERWM	18							18
M-5. Module of final attestation										
ECA213	Registration and protection of the master's project	RaPMP	8							8
Total by UNIVERSITY:								30	30	30
								60		30


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	6	9	15
PD	Cycle of profile disciplines	14	35	49
	Total for theoretical training:	20	44	64
ERWM	Experimental research work of a master's student	18		18
RaPMP	Registration and protection of the master's project	8		8
	Total:	46	44	90

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.

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"

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Representative of the Council from employers

 V.V. Pokusov