

AGREED

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

A.K. Mustafina
« 19 » 03 2024

APPROVE

Chairman of the Board – Rector of
JSC «International University
of Information Technologies»

A.K. Khikmetov
« 27 » 03 2024

**EDUCATIONAL PROGRAM
6B06302 «Hardware security»**

Education Area Code and Classification: 6B06 – Information and Communication Technologies
Code and classification: 6B063 – Information security
Group of educational programs: B058 — Information security
Level according to the International Standard Classification of Education (ISCE): 6
Level according to National Qualifications Framework (NQF): 6
Level according to Industry Qualifications Framework (IQ): 6
Duration of study: 3 years
Credits: 240

AGREED

Director of the Chairman of the ALE
«Kazakhstan Information
Security Association»

V.V. Pokusov
« 19 » 03 2024



AGREED

General director of the
«National Innovation
Center»

« 19 » 03 2024



Table of contents

List of abbreviations and designations.....	3
1. Description of the educational program.....	4
2. Purpose and objectives of the educational program	4
3. Requirements for evaluating the learning outcomes of an educational program.....	5
4. Passport of the educational program.....	5
4.1 General information	5
4.2 Matrix for correlating the learning outcomes of the educational program with the competencies being formed.....	10
4.3. Information about modules/disciplines	10
4.4. List of modules and learning outcomes.....	31
5. Curriculum of the educational program	34
6. Additional educational programs (Minor)	37
7. List of approvals with developers	38

1. Description of the educational program

At the present stage of development of our state, the issue of ensuring public procurement for national defense and security with domestic hardware and software has become acute, which is reflected in the Action Plan for the implementation of the Cybersecurity Concept ("Cyber Shield of Kazakhstan") until 2022, approved by the Decree of the Government of the Republic of Kazakhstan. Due to the state need, there is an urgent need to train specialists who are able not only to issue a qualified opinion on the results of instrumental inspections of IT and telecom equipment on the possibility of its use at critical informatization facilities, but also in the future to participate in research on the development of their own hardware. This educational program is written based on the recommendations of the Professional Standards of the Republic of Kazakhstan "Information Infrastructure and IT Security professionals" (Appendix No. 11 to the order of the Acting Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" No. 222 dated 05.12.2022), follows new trends from the Atlas of New Professions, Regional standards, National Qualifications Framework and the Industry Qualifications Framework according to level 6.

The educational program "Hardware Information Security Tools" is designed to provide practice-oriented training for graduates in the field of protecting critical information circulating in information systems from unauthorized access, including using methods and means of cryptographic information protection designed to work in various industries and in business.

An information security hardware specialist is an employee who deals with the development, implementation and maintenance of the technical section of the information security system at the enterprise. The main activity of a specialist in the field of information security hardware is related to secure computing systems and technical means of processing, storing and transmitting information; information security services; mathematical models of processes arising during information protection.

The educational program "Information Security Hardware" was developed on the basis of an analysis of the labor functions of professional standards in the field of information security and information and communication technologies for the 6th level of qualification (bachelor, practical experience). The developed EP "Hardware information security tools" meets the needs of stakeholders (students, employers, the state) and external qualification requirements.

2. Purpose and objectives of the educational program

The purpose of the EP is training highly qualified personnel for innovative and knowledge-intensive industries in the field of information protection, possessing theoretical and practical knowledge, skills and abilities necessary for their implementation in professional activities, meeting the needs of domestic and global intellectual labor markets, ready to make a qualitative leap in information security.

Tasks of the EP:

1. To provide practice-oriented training of graduates in the field of creation, implementation and maintenance of the technical section of the information security system designed to work in various industries and businesses.
2. To prepare graduates for professional activity in the field of information security using technical means.
3. To meet the needs of the market with specialists in information security hardware.
4. Create conditions for continuous professional self-improvement, the development of social and personal qualities of graduates (dedication, organization, hard work, sociability, ability to work in a team, responsibility for the final result of their professional activities, civic responsibility, tolerance), social mobility and competitiveness in the labor market.

		<p>markets, ready to make a qualitative leap in information security</p>
<p>7</p>	<p>Qualification characteristics of an EP graduate</p>	<p>The field of professional activity of a graduate of the EP: is designed to provide practice-oriented training of graduates in the field of protecting critical information circulating in information systems from unauthorized access, including using methods and means of cryptographic information protection designed to work in various industries and in business. An information security hardware specialist is an employee who deals with the development, implementation and maintenance of the technical section of the information security system at the enterprise. The main activity of a specialist in the field of information security hardware is related to secure computing systems and technical means of processing, storing and transmitting information; information security services; mathematical models of processes arising during information protection</p> <p>Objects of professional activity of graduates of the EP:</p> <ul style="list-style-type: none"> - Architecture of the Internet of Things, software development for it, design and setup of networks of interaction between sensors and devices - SMART technologies of various profiles and complexity, as well as their integration and interaction for the development, configuration and management of complex networks of autonomous data exchange and analysis - Neuronet - Mixed realities - Artificial intelligence - Quantum computing and cryptography <p>The subject of professional activity: Enterprises in various industries, both government and business</p> <p>Types of professional activity of an EP graduate:</p> <ul style="list-style-type: none"> - Blockchain technologist - Cyberprotector - IoT specialist <p>The functions of the professional activity of a graduate of the EP:</p> <ul style="list-style-type: none"> - Design, architecture, development and implementation of IoT networks - Customization, configuration and integration of IoT networks of various levels, scales, profiles and types - Improvement and expansion of IoT network packages

	<p>selected subject area, the ability to configure and adjust software and hardware complexes, the ability to interface hardware and software as part of information and automated systems</p> <p>PC4. The ability to apply the theory and principles of designing, organizing and administering operating systems, the ability to install, debug software and configure technical means for putting information systems into operation, the ability to maintain the operability of information systems and technologies in specified functional characteristics and compliance with quality criteria</p> <p>PC5. The ability to design distributed information systems, their components and protocols of their interaction, the ability to administer local and remote network resources, the ability to use methods and means of troubleshooting in networks</p> <p>PC6. The ability to use diagnostic and testing equipment, the ability to take into account current trends in the development of electronics, measuring and computing equipment, information technology in their professional activities, the ability to perform the calculation and design of electronic devices, circuits and devices of various functional purposes in accordance with the terms of reference using design automation</p> <p>PC7. The ability to develop user interfaces for web and mobile applications, the ability to develop models of information system components, including database models, the ability to develop components of software systems and databases, use modern programming tools and technologies, the ability to organize the interaction of devices connected via the Internet in order to solve the stated problem, as well as to organize the necessary data processing and visualization</p> <p>PC8. The ability to use the methodology for developing measures to protect confidential information, the ability to issue technical specifications in accordance with the requirements of state, industry and corporate standards, comply with the norms of work completion time, the ability to prepare materials for presentation to the customer, the ability to use modern information and communication technologies in subject activities, the ability to master project management methods and implement them using modern information and communication technologies, the ability to use an information approach to assess the quality of information security systems</p> <p>PC9. The ability to apply methods of protecting information from leaks through technical channels, the ability to apply technical means to ensure information security, the ability to apply cryptanalysis, the ability to audit the information security of an enterprise, the ability to apply international, national and corporate standards, the ability to identify possible ways of leakage of confidential information, the ability to comply with the requirements of the information security instructions of the department, the ability to organize work places and their technical equipment, placement of facilities and equipment of information and communication facilities</p>
12	<p>Learning outcomes of the educational program:</p> <p>LO1. Demonstrate the ability to conduct interdisciplinary scientific research using basic knowledge from the fields of economics and law, ecology and life safety. The ability to apply entrepreneurial qualities to the tasks of calculating the profitability of scientific projects. The ability to build personal and interpersonal relationships in compliance with the anti-corruption culture</p> <p>LO2. Demonstrate the ability to write and communicate orally in the state language and the language of interethnic communication, use foreign sources of information, possess communication skills, master office management techniques in the state language, have public speaking skills, argumentation, discussion and polemics in a professional foreign language</p> <p>LO3. Be able to use a variety of mathematical and natural science physics methods to solve specific engineering problems. Possess mathematical apparatus for the design of hardware components and electrical networks and digital circuit design</p> <p>LO4. Demonstrate an understanding of history and philosophy as a methodology of human</p>

4.2 Matrix for correlating the learning outcomes of the educational program with the competencies being formed

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12	LO13	LO14
PC1	V												V	
PC2		V				V	V							
PC3		V	V	V	V									
PC4				V	V	V	V							
PC5				V										V
PC6					V								V	V
PC7						V	V					V	V	V
PC8								V	V	V	V	V	V	V
PC9									V	V	V	V	V	V

4.3. Information about modules/disciplines (if there are modules, it is necessary to highlight them)

No.	Name of the discipline	Brief description of the discipline (30-50 words)	Number of credits	Formed competencies (codes)	Prerequisites	Postrequisites
The cycle of general education disciplines						
Required component						
1	History of Kazakhstan	This course is the most important general education discipline of the university component, studied by 1st year students of all educational programs. The history of Kazakhstan is an integral and integral part of world history, all events and cultural monuments are an important component of world history and culture. During the study of this course, students will acquire knowledge, skills and abilities in all major periods and subperiods of the history of Kazakhstan.	5	OK1	none	Philosophy

		professional Kazakh/Russian languages is not only the improvement of skills and abilities acquired at school, but also a means of mastering a future specialty				
5	Sociology-Political science	<p>The course "Sociology" examines various phenomena of social life. At the same time, the research is carried out from various paradigms of public knowledge, using theories and scientific methods. Students who have successfully completed the course will be able to:</p> <ol style="list-style-type: none"> 1. Use qualitative and quantitative research methods that will be useful in the scientific and professional field. 2. Distinguish between scientific and non-scientific knowledge. 3. To understand and analyze social phenomena and problems from different points of view. 4. Be able to work in a team. <p>The Political Science course provides comprehensive coverage of all key elements, the study of sources and political relations, types of political systems, democratic and authoritarian systems, political mechanisms, political competition and power, political</p>	4	OK1	none	Cultural studies- Psychology

		<p>playing games and educational discussions of various formats; case study (analysis of specific situations); project method. The Psychology course presents psychology issues in a broad educational and social context. The knowledge, skills and abilities acquired and formed as a result of mastering the course content give students the opportunity to apply them in practice in various spheres of life: personal, family, professional, business, social, in working with people from different social groups and age categories</p>				
8	Philosophy	<p>The object of study of the discipline is philosophy as a special form of spiritual studies in its cultural and historical development and modern sound. The main directions and problems of world and national philosophy are studied. Philosophy is a special form of cognition of the world, creating a system of cognition of the general principles and foundations of human life, about the essential characteristics of man's attitude to nature, society and spiritual life, in all its main direction</p>	5	OK1	History of Kazakhstan	Research methodology

		<p>responsibility for participation in corruption violations.</p> <p>2. Identify conflicts of interest in the activities of organizations leading to corruption.</p> <p>3. To analyze the work of organizations using various research methods</p>			
12	<p>Fundamentals safety of life activity and ecology</p>	<p>Studies the ways of safe human interaction with the environment (industrial, household, urban, natural), the sustainable functioning of business facilities (organizations) in emergency situations, issues of protection from negative factors, prevention and elimination of consequences of natural and man-made emergencies and the use of modern means of destruction.</p> <p>The course also reveals the role of ecology in solving modern economic, social and political problems, as well as the emergence of global environmental problems as a result of human production activities and the responsibility of the world community for them. International cooperation to ensure sustainable development is also a very important aspect. Various areas of practical</p>	EC 3	<p>Information and Communication Technologies</p>	<p>Diploma project</p>

		analysis, which is based on the theory of differential and integral calculations				
15	Legal Basics of Information Security	A course to study politics and information security on a global scale. Study of Kazakh and international laws and regulations in the field of information security	4	PC1, PC8, EC1	none	Computer Information Protection Technologies
16	Algorithmization and Programming	An introductory programming course that studies linear, conditional, repetitive structures of algorithms; one-dimensional and two-dimensional arrays and strings in the C++ programming language. Programming using procedures, functions and standard modules is considered	6	PC2	Information and Communication Technologies	Object-oriented programming (Java)
17	Algebra and Geometry	The successful application of algebra and geometry to solve specific problems is primarily due to the rapid growth of computing technology. The course includes analytical geometry and linear algebra. Linear algebra is a branch of mathematics that studies matrices, vectors, vector spaces, linear transformations and systems of linear equations. Analytical geometry is a section where the basic concepts are simple geometric shapes (points,	4	PC3 EC5	none	Mathematical analysis

		of analysis of electrical circuits, resistive circuits, 1st and 2nd order circuits; circuits with DC and AC sources				
23	Basics of the Linux operating system	The course provides students with basic Linux knowledge and basic Linux command line skills	4	PC4	Information and Communication Technologies	Security of operating systems
24	Mathematical foundations of information security	The course is aimed at studying the sections of discrete mathematics, as well as probability theory and mathematical statistics required to study information security processes	6	PC3 EC5	Mathematical analysis	Information Theory
25	Switching, Routing, and Wireless Essentials	Teach students how to configure routers and switches for advanced functionality, configure aggregation, redundancy and routing protocols, troubleshoot device problems and fine-tune routing protocols	6	PC5	Computer Networking Basics	Security of operating systems
26	Digital circuit design	This course is designed and formulated to help students understand, solve, and develop digital logic circuits. This course contains detailed lectures that not only define or describe logical elements, but also examples and problems with which you can learn the real implementation and operation of logical elements	4	PC3, PC6	Physics	IoT technology
27	Electronics	This course provides a basic understanding of	4	PC6	Basic Circuit Theory	IoT technology

32	IoT technology	The course is devoted to the study of circuits and microcontroller programs using Arduino and various components, programs using Python for Raspberry Pi to provide the functionality of the Internet of Things, systems for the Internet of Things	5	PC6	Basic Circuit Theory	IoT security
33	Project Management in Information Security	The course teaches how to use project management tools at various stages of the project life cycle, to make a qualitative and quantitative assessment of project risks, to determine the effectiveness of the project	5	PC8	Legal Basics of Information Security	Writing and defending diploma project
34	Research methodology	The course is devoted to the study of activities aimed at developing students' ability to make independent theoretical and practical judgments and conclusions, the ability to objectively evaluate scientific information, freedom of scientific search and the desire to apply scientific knowledge in educational activities, including for the completion of a thesis project (work)	3	EC3	Philosophy	Writing and defending diploma project
The cycle of basic disciplines Component of choice						
35	Computer Systems Architecture	The course introduces the basic structure of a modern programmable	4	PC4	Basics of the Linux operating system	Diploma project

		construction, types and functions of operating systems and their protection system				
40	Microcontroller Programming	The course is devoted to the study of methods for creating programs for information management systems, the development and testing of microcontroller programs through instrumental computer systems. The course examines approaches and methods of programming microcontrollers, special tools for programming microcontrollers, creating and testing microcontroller programs through instrumental computer systems	4	PC6	Digital circuit design	Biometric Access Control Systems
41	Cryptographic methods of information security	The course provides knowledge of the principles of cryptology, cryptography, and cryptanalysis. mathematical foundations of algorithms for asymmetric and symmetric cryptosystems, electronic digital signature. Be able to apply cryptography in the development of information security systems in practice	5	PC9	Computer Information Protection Technologies	Diploma project
42	Design Pattern	The course is designed for students who seek to deepen their knowledge in the field of software design and acquire skills in developing	4	PC2, PC7	Web technologies	Security of operating systems

		functions that support telephony, sending/receiving SMS, connection management via Wi-Fi, Bluetooth, programming background services, notification and alarm mechanisms, application interaction with geolocation and mapping services				
48	Smart technologies	The subject of the discipline is information technology infrastructure, software usage, communication systems, information centers, networks and databases. The purpose of this course is to study the rapidly developing and changing technologies in the field of embedded systems, sensors, wireless networks, Internet of Things (IoT). The course includes obtaining solid programming skills in various modern programming languages, including C++, Java, Python, including applications to IoT, cybersecurity, data processing and analysis		PC6	IoT technology	IoT security
49	Protection of database management systems	The course provides an overview of various concepts and methods for ensuring the security of a database management system. Topics cover advanced SQL, transaction	4	PC9	Organization of database management systems	Diploma project

		controlling hardware devices using the Python programming language. During the course, students will learn how to use Python to develop applications that work with hardware devices such as microcontrollers, sensors, actuators, and others. They will also study data exchange protocols and device management methods				
53	Minor 3	An additional educational program (Minor) is a set of disciplines and (or) modules and other types of educational work determined by the student for study in order to form additional competencies	5	PC2, PC9	Computer Information Protection Technologies	Research methodology
54	DevNet	The course is aimed at understanding the meaning, configuration and use of software concepts, as well as tools related to network programming (scripting in Python, Git, JSON, Postman, API). Description of the proprietary software-defined Network (SDN) approach, including centralized application policy management	4	PC7, PC9	Computer Networking Basics	Diploma project
55	Hardware security encryption technologies	This course will discuss in detail the goals, methods and ways of implementing various encryption technologies for		PC6, PC9	IoT security	Diploma project

		and justifying technical solutions in the construction of information security systems, studying the basic provisions of the BSDD theory and methods of their use in the tasks of identification, authentication, access control and management based on biometric characteristics of users and their application				
--	--	---	--	--	--	--

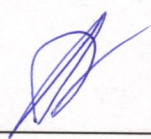


		<p>A is the actual amount of acquired knowledge, skills; F is the full amount of knowledge, skills proposed for assimilation</p>	<p>Microcontroller Programming IoT technology Smart technologies Electronics Computer Networking Basics Switching, Routing, and Wireless Essentials DevNet Basics of the Linux operating system Security of operating systems Computer Systems Architecture Research methodology Project Management in Information Security Economics and Industrial Engineering Startups and entrepreneurship Fundamentals of law and anti-corruption culture Fundamentals safety of life activity and ecology Basics of Financial Literacy Computer Information Protection Technologies Cryptographic methods of information security Legal Basics of Information Security Practical pentesting Protection of database management systems Blockchain technology Introduction to Intelligent Cybersecurity</p>
Computer Network Basics Module	LO 8	<p>where S is the assessment of academic performance (learning, productivity); A is the actual amount of acquired knowledge, skills; F is the full amount of knowledge, skills proposed for assimilation</p> $S = (A/F) * 100\%$	
OS Security Module	LO 5	<p>where S is the assessment of academic performance (learning, productivity); A is the actual amount of acquired knowledge, skills; F is the full amount of knowledge, skills proposed for assimilation</p> $S = (A/F) * 100\%$	
Module of scientific activity and project management	LO 1	<p>where S is the assessment of academic performance (learning, productivity); A is the actual amount of acquired knowledge, skills; F is the full amount of knowledge, skills proposed for assimilation</p> $S = (A/F) * 100\%$	
Information Security Technology Module	LO 6, LO 9, LO 12	<p>where S is the assessment of academic performance (learning, productivity); A is the actual amount of acquired knowledge, skills; F is the full amount of knowledge, skills proposed for assimilation</p> $S = (A/F) * 100\%$	

5. Curriculum of the educational program

Module code	Discipline cycle	Discipline component	Code of subject	Subject name	Academic credits	Academic study period	Control in the academic period	Number of hours				Distribution of credits per academic period									
								Classroom work				Independent work of students		1 course		2 course		3 course			
								Total	Lectures	Laboratory trainings	Practice	Practice	Independent work of students with faculty staff	Independent work of students	1	2	3	4	5	6	
																					Number of weeks in the academic period
General modules																					
Modules of specialty/education program																					
Additional modules beyond qualification																					
Modules of choice																					
1	GER	CS	LAN6001A	Foreign language	5	1	1	5/150				45		15	90	5					
2	GER	CS	LAN6001KR	Kazakh (Russian) language	5	1	1	5/150				45		15	90	5					
3	GER	CS	ICT6001	Information and Communication Technologies	5	1	1	5/150	15	30				15	90	5					
4	GER	CS	HK6002	History of Kazakhstan	5	1	1	5/150	15			30		15	90	5					
5	GER	CS	SPS6007	Sociology-Political science	4	1	1	4/120	15			30		15	60	4					
6	GER	CS	LAN6002A	Foreign language	5	2	2	5/150				45		15	90	5					
7	GER	CS	LAN6002KR	Kazakh (Russian) language	5	2	2	5/150				45		15	90	5					
8	GER	CS	PhC6005	Physical Culture	4	2	2	4/120				45		15	60	4					
9	GER	CS	SPS6006	Cultural studies-Psychology	4	2	2	4/120	15			30		15	60	4					
10	GER	CS	SPS6001	Philosophy	5	3	3	5/150	15			30		15	90	5					
11	GER	CS	PhC6006	Physical Culture	4	3	3	4/120				45		15	60	4					
12	GER	ES	JUR 6507	Fundamentals safety of life activity and ecology				5/150	15			30		15	90						
13	GER	ES	FIN6720	Basics of Financial Literacy	5	6	6	5/150	15			30		15	90						
14	GER	ES	JUR 6470	Fundamentals of law and anti-corruption culture				5/150	15			30		15	90						5
15	GER	ES	MGT6706	Startups and entrepreneurship				5/150	15			30		15	90						

7. List of approvals with developers

Name of the educational program:
6B06302 «Hardware Security»

No.	Position, academic degree and surname, first name, patronymic of the developer of the educational program	Date	Signature	Note
1	Amanzholova Saule Toksanovna Candidate of Technical Sciences Associate Professor			
2	Sagymbekova Azhar Oryngalieвна Master of Technical Sciences Senior Lecturer			
3	Makilenov Shakirt Nurlybekuly Master of Technical Sciences Senior Lecturer			
4	Askarbekova Nesibeli Yerkinzyzy Master of Technical Sciences Senior Lecturer		