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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.

		markets, ready to make a qualitative leap in information security
7	Qualification characteristics of an EP graduate	<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>

		<ul style="list-style-type: none"> - Sagymbekova A.O., senior lecturer - Makilenov Sh.N., senior lecturer - Askarbekova N.Y., senior lecturer
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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	5	OK1	none	Philosophy

		<p>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 capital and values, the survival of political ideas, nationalism, analysis of domestic and foreign policy, political growth, public policy in the global political system</p>				
5	Information and Communication Technologies	In the course, information and communication technologies are	5	PC4	none	Computer Networking Basics, Basics of the Linux operating system

		<p>used in the implementation of the program: role-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</p>	5	OK1	History of Kazakhstan	Research methodology

		<p>following competencies:</p> <ol style="list-style-type: none"> 1. Understand the measures of legal responsibility for participation in corruption violations. 2. Identify conflicts of interest in the activities of organizations leading to corruption. 3. To analyze the work of organizations using various research methods 			
12	Fundamentals safety of life activity and ecology	<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</p>	EC 3	Information and Communication Technologies	Diploma project

		methods of studying infinitesimal variables using analysis, which is based on the theory of differential and integral calculations				
15	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, lines, planes, curves and surfaces of the second order). The main means of research in analytical geometry are the coordinate method and the methods of elementary algebra.	4	PC3 EC5	none	Mathematical analysis
16	Educational practice	The course is designed to study the basics of information security	2	PC4	Algorithmization and Programming	Industrial practice
17	Algorithmization and Programming	An introductory programming course that studies linear, conditional, repetitive structures of algorithms; one-dimensional and two-dimensional	6	PC2	Information and Communication Technologies	Object-oriented programming (Java)

		theory commonly used in engineering research and scientific applications. Methods and principles of analysis of electrical circuits, including basic concepts such as voltage, current, resistance, impedance, Ohm's and Kirchhoff's law; basic methods of analysis of electrical circuits, resistive circuits, 1st and 2nd order circuits; circuits with DC and AC sources				
24	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
25	Professionally oriented foreign language	It includes a grammar course, lexical material of a professional nature and texts of a professional orientation	4	EC4	Foreign language	Diploma project
26	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
27	Web technologies	This course teaches the basics of website development using HTML, Cascading Style Sheets (CSS), JavaScript and jQuery. Teaches you how to use the PHP programming language, master	4	PC7	Object-oriented programming (Java)	Design Pattern

		conceptual stage and ending with the physical implementation				
32	Foreign Language 1 (German)	The course is designed to study the basic vocabulary of a common language, representing a neutral scientific style and professional vocabulary; the basic lexical and grammatical norms of a foreign language, the lexical minimum in the amount necessary to work with professional literature and interact in German	10	EC4	Professionally oriented foreign language	Foreign language
33	Cloud Computing	The discipline is aimed at gaining practical skills in using modern cloud infrastructures, platforms and services to create applications and solve typical tasks. The course examines the concept and models of cloud computing, the architecture and principles of implementing scalable, highly accessible cloud-based applications, modern practices for developing cloud-native applications, as well as existing cloud solutions for data storage and processing. The discipline has a practical focus and includes homework for the development, deployment and testing of applications in a real public cloud	5	PC6	Information Theory	Applied AI

		completion of a thesis project (work)				
The cycle of basic disciplines						
Component of choice						
37	Subject-specific elective module 1	The elective is selected from the following subjects - Data Analysis and Data Mining (FWPM) - Deep Learning for Natural Language Understanding (FWPM) - Digital Technology (FWPM) - Embedded Systems (FWPM) - Industry 4.0 in Planning and Production (FWPM) - Industrial Data Analysis (FWPM) - Cryptology (FWPM) - Project Management (FWPM) - - RESTful Web Services (API) - - Corporate Governance (FSUE)	5	PC2	Object-oriented programming (Java)	Subject-specific elective module 2
The cycle of core disciplines						
The university component/Component of choice						
38	Industrial practice	The course is dedicated to the study of information security technologies	8	EC2	Educational practice	Pre-graduate practice
39	Computer information protection technologies	Basic methods and principles of information protection	4	PC8	Computer Networking Basics, Basics of the Linux operating system	IoT Security
40	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 flexible, supported and extensible systems. The course covers both theoretical and practical aspects of	4	PC2, PC7	Web technologies	Security of operating systems

		for writing a thesis project				
45	Minor 1	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	Minor 2
46	Subject-specific elective module 2	The elective is selected from the following subjects - Data Analysis and Data Mining (FWPM) - Deep Learning for Natural Language Understanding (FWPM) - Digital Technology (FWPM) - Embedded Systems (FWPM) - Industry 4.0 in Planning and Production (FWPM) -Industrial Data Analysis (FWPM) - Cryptology (FWPM) - Project Management (FWPM) - - RESTful Web Services (API) - - Corporate Governance (FSUE)	5	PC2	Subject-specific elective module 1	Subject-specific elective module 3
47	Subject-specific elective module 3	The elective is selected from the following subjects: - Programming .NET in C# (FWPM) - Artificial Intelligence in Robotics (FWPM) - Introduction to Microsoft Dynamics NAV (FWPM) - Evaluation and selection of a standard software package (FWPM)	5	PC2	Subject-specific elective module 2	Subject-specific elective module 4

		scientific terminology, methods and means of choosing 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				
50	Managing the security of reconfigurable integrated systems	The course is designed to teach students security techniques in reconfigurable embedded systems. During the course, students learn the principles of security management, including methods of risk analysis, threat and risk identification, as well as evaluating the effectiveness of security measures		PC6, PC9	IoT security	Diploma project
51	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

4.4. List of modules and learning outcomes

Name of the educational program: 6B06305 «Hardware security»




Qualification: Bachelor of Information Security

Module Code / Module Name	Learning outcomes	Criteria for evaluating learning outcomes	Disciplines forming the module Code / Name
GENERAL EDUCATION MODULES			
Humanitarian module	LO 1, LO 4	$S = (A/F) * 100\%$, 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	History of Kazakhstan Philosophy Sociology-Political science Cultural studies-Psychology Intercultural Competence
Language module	LO 2	$S = (A/F) * 100\%$, 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	Foreign language Kazakh (Russian) language Foreign Language 1 (German) Professionally oriented foreign language
The ICT module	LO 5	$S = (A/F) * 100\%$, 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	Information and Communication Technologies
BASIC MODULES			
Natural Science module	LO 3	$S = (A/F) * 100\%$, 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	Algebra and Geometry Mathematical analysis Physics Information Theory Mathematical foundations of information security
Programming Languages Module	LO 7	$S = (A/F) * 100\%$, 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	Algorithmization and Programming Object-oriented programming (Java) Design Pattern Web technologies Organization of database management systems Data Science Subject-specific elective module 1 Subject-specific elective module 2 Subject-specific elective module 3

6	Additional courses		Number of credits	Academic period	Number of hours	Number of weeks
7	Module of final certification (MoFC)		8		240	
	Total including FCS		240		7200	

7. List of approvals with developers

Name of the educational program:
6B06305 «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 Oryngaliyevna 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		