Institute of Automation and information technologies
Department of Cybersecurity, information processing and storage

EDUCATIONAL PROGRAM
6B06301 "Information Security"

Code and classification of the field of education: **6B06 "Information and communication technologies"**
Code and classification of training directions: **6B063 "Information security"**
Group of educational programs: **B058 "IT security"**
Level based on NQF: **6**
Level based on IQF: **6**
Study period: **4 years**
Amount of credits:**240**

Almaty 2023

Educational program 6B06301 "Information security" was approved at the meeting of K.I.Satbayev KazNRTU Academic Council
Minutes # 5 dated "24" November 2022.

Was reviewed and recommended for approval at the meeting of K.I.Satbayev KazNRTU Educational and Methodological Council
Minutes # 3 dated "17" November 2022.

Educational program 6B06301 "Information security" was developed by Academic committee based on direction 6B063 "Information security".
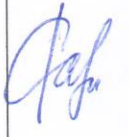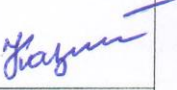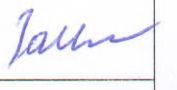
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List of abbreviations and designations

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
IT – information Technology

1. Description of educational program

The educational program 6B06301 "Information Security" is aimed at teaching students general education, basic and specialized disciplines with the achievement of relevant competencies:

- To provide practice-oriented training of specialists in the field of information security, ensuring the security of systems and networks, cryptographic and technical protection of information for operational and project activities.

- To prepare graduates for production and technological activities related to the process of organization, design, provision, management of databases, network technologies, cloud technologies, intrusion prevention and detection systems, organizational and legal aspects of information security, focused on meeting the expectations and requirements of users; to organizational and managerial activities related to maintenance, organization and information security management.

- Create conditions for continuous professional self-improvement, development of social and personal competencies of graduates (broad cultural outlook, active citizenship, commitment, organization, diligence, sociability, ability to argue and make organizational and managerial decisions, knowledge of modern information technologies, fluency in several languages, striving for self-development and commitment to ethical values and a healthy lifestyle life, the 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.

The content of the disciplines of the educational program is developed taking into account the relevant educational programs of the world's leading universities, the international classifier of professional activity in the field of information security.

Graduates of the educational program 6B06301 "Information Security" are focused on the organization, design and development of systems for the protection and security of information for applied purposes for all sectors of the economy, government organizations and other fields of activity.

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. Student–centered learning is provided - the principle of education, which assumes a shift of emphasis in the educational process from teaching (as the main role of the teaching staff in the "translation" of knowledge) to teaching (as an active educational activity of the student).

The educational program provides training of specialists in the field of information security in 3 directions:

- security of systems and networks. Training of specialists who ensure the security of systems and network technologies of a wide range. The educational program provides the acquisition of knowledge on computer information security technologies, network technologies, organization of computing systems and networks, administration of systems and networks, security of cloud technologies,

acquisition of skills in designing and developing secure databases, intrusion prevention and detection systems.

- cryptographic protection of information. Training of specialists in cryptographic protection of information. The educational program provides the acquisition of knowledge on the mathematical foundations of cryptography, various models, methods and means of cryptographic information protection, computer information protection technologies, the development and design of cryptographic information protection tools, the basics of standardization and certification of information security tools, the acquisition of skills in the construction of cryptographic information security tools.

- technical protection of information. Training of specialists in technical protection of information. The educational program provides the acquisition of knowledge in the field of electronics, digital circuitry, microprocessor technology, programming of microcontrollers, knowledge of various methods and means of technical protection of information, organization and management of the information security service, ensuring the continuous functioning and operational activities of IT support.

The educational program was developed on the basis of an analysis of the labor functions of information security engineers, system administrators, information security specialists stated in professional standards.

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

In case of successful completion of the full bachelor's degree course, the graduate is awarded a bachelor's degree in the field of information and communication technologies according to the educational program 6B06301 "Information Security".

2. Purpose and objectives of educational program

Purpose of EP: Preparation of a competitive generation of technical specialists in the field of information protection and safety for the labor market, an initiative, able to work in a team, possessing high personal and professional competences.

Tasks of EP:

– socio-humanitarian and professional training of bachelors in the field of information security in accordance with the development of science and production, as well as with the needs of clusters of information security of Kazakhstan, National Security of the Republic of Kazakhstan, national research centers, master's and doctoral studies of higher educational institutions;

– integration of educational and scientific activities;

– establishing partnerships with leading universities of the near and far abroad in order to improve the quality of education;

– expansion of relations with customers of educational services, employers in order to determine the requirements for the quality of training of specialists,

conducting courses, seminars, master classes, internships, industrial practices.

The content of the educational program "Information Security" is implemented in accordance with the credit technology of training and is carried out in the state and Russian languages.

The educational program will make it possible to implement the principles of the Bologna process. Based on the students' choice and independent planning of the sequence of studying disciplines, they independently form an individual study plan for each semester according to the Working Curriculum and the Catalog of elective disciplines. The volume of mathematical, natural science, basic and language disciplines has been increased in the educational program.

The following disciplines are studied: "Digital circuitry", "Algorithmization and programming basics", "Information fundamentals of information security", "Organizational and legal aspects of information security and computer forensics", "Computer architecture and consistency of operations", "Security of operating systems", "Cryptographic information security systems", "Security of cloud technologies", "Computer Networks", "Blockchain Technologies", "Computer Information Protection Technologies", "Design and protection of server databases", "Social Engineering and Ethical Hacking", "Technical means and methods of information protection", "Designing secure Web applications", etc.

Students have internships in banking structures, government and departmental structures, in such companies as JSC "National Information Technologies", LLP "Pacifica" - integrator in the field of information security, LLP "Galaxy", the Center for Analysis and Investigation of Cyber Attacks, etc.

According to the academic mobility program, the best students have the opportunity to study at leading foreign universities according to the corresponding EP.

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	6B06 "Information and communication technologies"
2	Code and classification of training directions	6B063 "Information security"
3	Educational program group	B058 "IT security"
4	Educational program name	6B06301 "Information security"
5	Short description of educational program	The program corresponds to the educational programs of the world's leading universities and the international classifier of professional activity in the field of information security. OP is focused on the organization, design and development of systems for the protection and security of information for applied purposes for all sectors of the economy, government organizations and other fields of activity
6	Purpose of EP	Preparation of a competitive generation of technical specialists in the field of information protection and safety for the labor market, an initiative, able to work in a team, possessing high personal and professional competences.
7	Type of EP	Новая
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	Нет
11	List of competencies of educational program	Information security, Security of network technologies, Cryptographic protection of information, Technical protection of information.
12	Learning outcomes of educational program	ON1: Ensure the integrity and reliability of data in databases using integrity constraints, views, triggers, and stored procedures. Perform backup, restore, monitoring and audit of database systems. Use the capabilities of the SQL language to protect database systems, manage access rights, encrypt database objects. ON2: The ability to understand and apply methodologies and technologies for performing graphic work on a computer, express technical ideas using a drawing, present diagrams in a graphical form, use computer graphics and graphic dialogue tools.ON3: ON3: Use the fundamental concepts of mathematics, physics and mechanics in professional activities. Conduct mathematical proofs, solve mathematical problems and problems. Be competent in the application of information theory to ensure the protection and security of information.

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		ON4: Apply the basic methods of formalizing reasoning, the basic concepts of the theory of logical functions, theory of algorithms, graph theory, coding theory; use the conceptual apparatus and methods of discrete mathematics to analyze mathematical models in solving problems of professional activity. ON5: Use the methods of constructing various models of data types, information processing algorithms; make rational use of the opportunities provided by the algorithmization technique. Apply a unified modeling language, implement a structural and object-oriented approach to working with tools. ON6: Perform typical tasks of design, deployment and technical support of local and global networks; Administer networks in modern operating systems. Ensure the safety and resiliency of the network and servers. ON7: Apply database technology for the safe organization, receipt, storage, processing and transmission of information. Own the basics of designing secure databases and ensuring their protection. Ensure the integrity and reliability of data in databases. Be competent in the creation, development and design of secure Web applications. ON8: now the architecture of computer systems, the principles of construction. Select the elements of electronic circuits, make the necessary calculations, make a mathematical description of the functioning of the devices and determine their characteristics; determine the parameters of semiconductor devices and circuit elements. ON9: Know the basics of information security and its problematic aspects. Be able to apply basic indicators of information security. The ability to apply biometric information security technologies. To be able to use a number of implementation of algorithms to solve practical problems ON10: The ability to use virtualization systems and cloud technologies to solve practical problems and find vulnerabilities of virtual machines. Be able to apply standard recommendations for securing cloud technologies and the Internet of things. ON11: Analyze the principles of building cryptographic algorithms; develop and apply cryptographic systems; analyze and solve the issues of cryptographic information protection and the use of modern cryptographic methods of information protection. The ability to use the mathematical foundations of cryptosystem algorithms. ON12: Select elements of electronic circuits, make the necessary calculations. Participate in the development of projects of various electrical components and assemblies using microcontrollers. Program in C language. ON13: Ability to perform hands-on analysis and use data leak prevention systems. To manage security policies and

		all types of work of the information protection service. The ability to determine the optimal structure of the information protection service. Develop regulatory and methodological documents on the organization and functioning of the information protection service. ON14: The ability to identify possible channels of information leakage, to carry out technical measures for protection. Apply passive and active methods and means of information protection. Perform engineering and technical measures to protect and practically apply measures to protect objects and information from reconnaissance equipment. ON15: The ability to think logically, master the methods of induction and deduction, determine cause-and-effect relationships, understand various situations, and be economically literate. ON16: The ability to organize measures to ensure their own safety and the safety of teams in professional activities and social emergencies.
13	Education form	Full-time, online
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Bachelor's degree in information and communication technologies
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	ON12	ON13	ON14	ON15	ON16
Cycle of general education disciplines **Required component**																			
1	Foreign language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10			v												v	
2	Kazakh (russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural	10															v	

№	Discipline	Description	Credits																		
		and semantic text analysis.																			
3	Physical culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.	8																		v
4	Information and Communication technology (MOOC)	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5							v											
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the	5																	v	

		formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.																							
6	Philosophy (MOOC)	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.	5																				v	
7	Module of socio-political knowledge (sociology, political science) (MOOC)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of	3																				v	

		interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.		
8	Module of socio-political knowledge (cultural studies, psychology) (MOOC)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5	v
Cycle of general education disciplines **Component of choice**				
9	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption	5	v v

		culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline «Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.																						
10	Fundamentals of economics and entrepreneurship	Discipline studies the foundations of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for	5																				v	v

								v	v														
	innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.																						
11 Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies	5																				v	v
12 Algorithmization and programming basics	The course explores the fundamental concepts of programming: operator,	4				v	v															

		variable, procedure, function, data type. The main structures of algorithms are considered, such as linear, branched, cyclic. The course examines the basic forms of data representation: strings, structures, arrays, lists. Separate topics are devoted to the creation of widely used sorting algorithms, searching for the minimum and maximum values in an array, string processing, iterative and recursive algorithms, building flowcharts of algorithms and developing programs based on them.																				
13	Architecture of computer systems (Coursera)	Computing systems of various architectures are the hardware part of information technology, which reached a global character and content by the end of the XX century. Multiprocessor systems, which also include computer networks, allow by changing their architecture to optimize the parameters of the main processes of information technology: processing, accumulation, data transmission and knowledge representation. *	5					v			v											

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| 14 | Operating System Security | The purpose of the discipline is to master the basic means and methods of ensuring information security. Upon completion, students will learn to understand the principles of building information security. Will be able to classify and evaluate threats to information security; master professional terminology in the field of information security. Will be able to use the means of operating systems to ensure the efficient and safe functioning of automated systems; learn how to evaluate the effectiveness and reliability of protection of operating systems; acquire skills in planning the security policy of operating systems | 5 | | | | | | v | | | v | | | | | | | | |
| 15 | Introduction to specialty | Security objects. Data processing systems. Directions of information security. Information security and problematic aspects. Basic information security indicators. Information security risks. Socio-technical attacks. Technologies for the protection of information resources. Methods and tools of information protection. | 5 | | | v | | | v | | | | | | | | | | | |

		Software products for information protection. Physical tools to protect information. Prospects for the development of information security systems, intellectualization. Information security management.																							
16	Introduction to Web Programming	The methods of designing WEB applications using modern web programming technologies and software tools for solving applied problems using methods of debugging and testing web applications in the loop-back system are studied. The discipline studies the basics of creating web applications; classification of software tools; structure of web programs; web applications running on the client and server side; principles of developing an interactive user interface; organization of navigation; interface of server interaction with application programs; syntax and notations of markup languages, data structures, and scripting languages. Students gain skills and an understanding of the current prospects and trends in the	6				v	v															

		development of web programming.																							
Cycle of basic disciplines **University component**																								
17	Discrete Mathematics	The discipline deals with coding theory, set theory, graph theory, mathematical logic. Namely, the foundations of coding theory, set theory, graph theory; theory of logic algebra; mathematical apparatus for the synthesis and analysis of digital devices, transform Boolean functions, synthesizing minimal combinational circuits; performing coding.	5			v	v																		
18	Information basis of information protection	Application of information theory in information security systems, basic concepts of information theory, measures and forms of representation of discrete information, number systems for representing numerical information, problems of information transmission, alphabetical representation of information, basics of encoding and encryption of discrete informatio	5			v	v																		
19	Computer graphics	The course studies the generation of images on a computer, namely the	5		v																				

		mathematical and algorithmic foundations of computer graphics, raster graphics algorithms, 2D and 3D modeling, polygonal models. The technologies of using the OpenGL graphics library for generating 2D and 3D images, the use of auxiliary libraries are considered. After studying the discipline, students will be able to master any graphic tools, continue to study and use graphic libraries.																					
20	Computer Networks	The program of the training course is aimed at familiarizing students with the basics of organization, construction, architecture and principles of functioning of computer networks. The course focuses on the application of skills to the organization of real networks and examines the communication tools, protocols and standards of networks. As a result of mastering the discipline, students will learn how to configure and configure communication tools, select firewalls, and operate computer networks.	5						v														
21	Mathematics I	The course is devoted to the	5			v	v																

		study of the basic concepts of higher mathematics and its applications. The main provisions of the discipline are applied in the teaching of all general education engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, differential calculation of functions of one and several variables. Methods for solving systems of equations, problems of using vector calculations in solving problems of geometry, mechanics, and physics are considered. Analytical geometry on a plane and space, differential calculation of functions of one variable, derivatives and differentials, study of the behavior of functions, derivative and gradient in direction, extremum of a function of several variables.																							
22	Mathematics II	The discipline is a continuation of Mathematics I. sections of the course include integral calculus of a function of one variable and several variables,	5			v	v																	

		series theory. Indefinite integrals, their properties and methods of their calculation. Certain integrals and their application. Incorrect integrals. Numerical series theory, functional series theory, Taylor and Macloren Series, application of series to approximate calculations.																			
23	Mathematics III	The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied.	5			v	v												v	
24	Microelectronics	The principles of operation, parameters, characteristics and features of the use of	5			v					v					v				

		semiconductor devices are considered. Designing various circuits of amplifiers of electrical signals and generators based on diodes, bipolar and field-effect transistors and testing the features of their functioning. Operational amplifiers. Differential amplifiers. Feedback. The influence of feedback on the main indicators and characteristics of amplifiers. Power amplifiers. Filter classification and composition																				
25	Basics of cryptographic protection of information (Coursera)	This course examines the basic concepts, terms and concepts of the discipline. Cryptology, cryptography, cryptanalysis. Durability, security, imitation durability, authenticity. Modern cryptographic methods of information protection. Basic principles of building cryptoalgorithms.	5			v								v								
26	Designing and protecting server databases	The course examines the basics of designing secure databases and ensuring their protection. Students will learn how to use database technologies to solve practical problems of developing and protecting secure server databases. In	5	v					v												

		addition, they will study ways of storing data at the physical level, types and ways of organizing file systems; – understanding problems and the main ways to solve them with collective access to data; – exploring the capabilities of DBMS that support various data organization models.					v																	
27	Digital Device Design	The program of the course is aimed at acquainting students with the basics of designing digital devices. The course is devoted to the application of formal logic and the theory of automata for solving practical problems of designing digital devices.	5				v					v												
28	Blockchain technologies	Principles, methods and means of blockchain technology to ensure information protection, counter information security threats. There also discusses the principles of using a replicated distributed block database to ensure information security and the application of the blockchain network in various fields.	5						v	v				v									
29	Physics I	Objectives: to study the basic physical phenomena and laws of classical, modern physics; methods of physical research;	5				v	v															

		the relationship of physics with other sciences. The following topics are considered: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell equations.																				
30	Physics II	The course studies the laws of physics and their practical application in professional activity. Solving theoretical and experimental-practical educational problems of physics for the formation of the foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of physical condition using a computer, study of modern measuring equipment, development of skills for conducting test studies and processing their results, distribution of the physical content of applied tasks of the	5			v	v														

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		future specialty.																						
31	Digital Circuitry	Fundamentals of building electrical circuit diagrams of nodes (blocks) of various electronic devices, including modern computers, methods of using various (semiconductor) logic elements. Creation of examples of schematic diagrams of the simplest electronic components based on CAD "Altium Designer" and design of the printed circuit board. Simulation of the operation of electrical circuits using various programs (for example, MICROCAP).	5			v			v				v									
32	Training practice	The main purpose of the training practice is to acquire students' practical experience in the field of information security. The training practice is intended for the formation of practical skills and professional training of students. The objectives of the practice include participation in the development and design of cryptographic information security tools, the basics of standardization and certification of information security tools, acquisition of skills in building secure	2							v					v						

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		networks and systems.																								
	Cycle of basic disciplines **Component of choice**																									
33	Vulnerability identification and analysis	The purpose of mastering the discipline is theoretical and practical training of students in the field of information security. The course content includes questions about typical vulnerabilities of network protocols, operating systems and applications. Concepts such as ethical hacking and social engineering are also considered. Methods of attacks on software systems, such as damage to program memory, code injection on the client or server side, etc., as well as methods and properties of modern programming languages to prevent the appearance of vulnerabilities of this kind are considered.	5																		v	v		
34	Pentest Tools	Standards and penetration testing tools, their role in information security audit. Categories of the pentest, their features. Programs and distributions for pentest, the principles of their construction and functionality. Using pentest tools to study threats, detect vulnerabilities, and	5																		v	v		

		detect cybercrimes.																							
35	Designing secure Web-based applications	The main trends in the development of Web-technologies. Basic web standards. The concept of Web applications and approaches to their development. Server controls. Structure and design of the Web application. Web application security. Development of Web services. Organization of web application security.	4								v	v													
36	Capstone project 1	The purpose of the course is to apply IT project management techniques, ways to transform ideas into a concrete solution and determine the most optimal approach to its implementation. The course participants will get a holistic view of the process, key techniques and tools necessary for the design, development and further development of their products and services.	5			v	v	v				v													
37	Capstone project 2	The course is aimed at studying and forming students' understanding of the process of attracting investments and scaling a business; the formation of practical skills in the field of attracting investments in a startup. In the	4			v	v	v				v													

		course of passing the discipline, students consider the following issues: search and identification of various sources of financing and selection of potential investors for business; applying to accelerators; preparation of investment documentation; creating investment presentations; presentation of the project to a potential investor.																							
38	Java EE technology	Basic concepts and terms. Java EE application architecture, client tier, middle tier, data access tier. Java EE technologies at various levels. Application servers, component containers and components, their relationship. Types of containers. Included APIs and Features: Servlet API, Java Server Pages, Java EE Security. Common Design Patterns in Java Enterprise.	5						v	v														
Cycle of profile disciplines **University component**																									
39	Securing cloud technologies	The curriculum is aimed at familiarizing students with the basics of cloud technologies and virtualization, ensuring their security. The course focuses on the application of	5						v				v											

№	Name	Description	Cr.																		
		virtualization technologies and cloud services for cloud computing.																				
40	Biometrics and neural networks	Biometric methods of information protection. Static and dynamic biometrics. Artificial neural networks. Classification, areas of application. Neural network learning algorithms. Errors of the first and second kind. Neural network models of biometric image recognition.	4										v								
41	Information security and object-oriented programming	The course examines the basic concepts of object-oriented programming and application development. The following issues are considered: application vulnerabilities, their classification; technologies for ensuring information security of applications. Students gain skills in using specialized tools to identify vulnerabilities and protect applications at the design and implementation stage, configuration and operation.	5														v			
42	Organizational and legal aspects of information security and computer forensics	The purpose of mastering the discipline is to familiarize students with the legal and organizational aspects of information security and the	4																v	v

		basics of computer forensics and cybercrime investigation. Issues addressed in the course regarding the application of regulatory legal and other documents regulating information security. Students' acquisition of knowledge and skills will help in solving crimes related to computer information, in the study of digital evidence, methods of searching, obtaining and securing such evidence.																				
43	Organization and securing databases	The curriculum is aimed at acquainting students with the basics of organizing secure databases, their application for solving real problems. The course is devoted to the application of database technology for solving practical problems of database development and database applications.	5					v		v											
44	Fundamentals of students' research work	The course is aimed at forming a comprehensive understanding of the specifics of research work; mastering research methods that are most relevant to the subject of research; acquiring skills and abilities of independent research activities. The course	4		v			v												v	

		content includes the basic concepts and classification of science and scientific information: its sources and methods of processing; types and forms of educational research and research work of university students. The requirements for the technical design of scientific work are considered.																				
45	Social engineering and ethical hacking	A systematic approach to computer security, methods of checking the security of various computer network nodes. The study toolkit intruders, with their advantages and limitations. Methods for successfully identifying and resolving security problems in mixed computer networks. The study of hacking techniques and hacking techniques in the context of the use of defensive practices and recommendations set forth by these hackers.	4				v						v			
46	Technologies of protection of computer information	Main concepts of technology of protection of computer information. Principal components of protection. Main types of threats of computer information.	4				v		v							

		Technologies of protection against viruses. Means of cracking of programs. Technologies of counteraction to program and hardware tabs, protection against interception of information at the expense of an electromagnetic radiation. Technologies of protection against interception of information at the expense of an electromagnetic radiation on networks of telecommunications. Technologies of identification and authentication of users and processes. Technologies of monitoring of an information access. Technologies of cryptography protection of programs and data.																				
47	Production practice I	The main purpose of production practice I is to provide students with the opportunity to apply their knowledge, skills and abilities in a real working environment. The production practice is aimed at acquiring practical experience in the field of information security. Production practice is carried out in public and private enterprises and organizations	2													v		v				v

		that develop, implement and use organizational, hardware and software methods and means of protecting information systems in all spheres of human activity, operating with critical information. The tasks of the internship include the participation of students in the organization of computer information protection, network technology, organization of computer systems and networks.																					
48	Production practice II	The main purpose of the production practice II is to provide students with work experience in real conditions for conducting information security of the organization. Production practice is carried out in public and private enterprises and organizations that develop, implement and use organizational, hardware and software methods and means of protecting information systems in all spheres of human activity, operating with critical information. The tasks of the practice include working in a team on real projects, including	3														v		v			v

		the administration of systems and networks, acquiring skills in designing and developing secure databases, intrusion prevention and detection systems, ensuring the continuous functioning and operational activities of IT support.																	

Cycle of profile disciplines
Component of choice

49	System and Network Administration	The material is mostly practical and contains a minimal amount of theory. The course is suitable both for novice system administrators who want to configure company servers, and for network engineers, because most of the networking equipment runs Linux and Windows.	5						v			v			v				
50	Internet of things security	Current components of typical IoT devices; trends for the future; limitations and interactions between the physical world and the IoT device; key network components for connecting an IoT device to the Internet; IoT security issues.	5						v			v							
51	Security of networking technologies	The modern technologies and main tendencies of creation of computer networks. Bases of	5						v						v				

		network technologies and terminology. Main network models. Methods of structuring networks, topology, types of networks, services, requirements. Switching methods. Technologies of creation of networks. Standards, protocols, access methods, network configurations. Routing protocols, addressing, switching. VLSM, CIDR, VLAN technologies. Wireless technologies. Design of local area networks. Cybersecurity. Vulnerabilities of software and hardware for network technologies, classification. Cybersecurity of networking technologies. Safety of corporate networks. Security management.																	
52	Cryptographic Information Security Systems	Block encryption. Components of a modern block cipher. The execution modes of block ciphers. Streaming encryption. The random number generator. The principles of using pseudo-random number generator streaming encryption. Asymmetric encryption systems. Effective encryption. The distribution of	5			v	v			v				v					

		keys. Cryptographic protocols. The hash functions. Electronic digital signature.																						
53	Mathematics of cryptography	The basic concepts, terminology and concepts of the discipline. Cryptology, cryptography, cryptanalysis. Encryption. Durability, security, imitoprotection authenticity. Modern methods of cryptographic information protection and encryption. The basic principles of encryption algo-rithms. Mathematical Foundations of algorithms asym-metric cryptosystems. Mathematical foundations of algo-rithms of symmetric cryptosystems. Researchmethods of cryptographic algorithms. Models of encryption systems. Mathematical Foundations of algorithms of digital signature. Managing cryptographic keys. Steganography. Mathematical foundations and algorithms.	5		v	v									v							
54	Microcontrollers	Programmable logical controllers (PLK, PLC) represent microprocessor devices, are intended for execution of algorithms of management, the principle of work of PLK consists in	5								v					v						

		collecting and data processing according to the application program of the user with delivery of the operating signals on actuation mechanisms; PLK can process discrete and analog signals, operate valves, servo-drives, converters of frequency and other devices; solvable tasks represent a set of programs; tasks can cyclically be caused, on an event, with the maximum frequency.																					
55	Organization and management of information security service	Purpose of the information security service. Information security service as an information security management body and an integral part of a security system. Types and types of organizational structures of the information security service. Organizational framework and principles of information protection service. The procedure for creating an information security service. Principles of organization and activities of the information security service. Organization of interaction between information security services and departments and external	5																v	v			v

F KazNRTU 703-05 Educational program

		information security services. Technology, principles and methods of managing information security services																			
56	The organization of microprocessor systems	The basic definitions, characteristics, scopes and features of work of microprocessor means. Designing of microprocessor systems. levels of representation of microprocessor system. Architecture of microprocessors of family Intel. Operating modes of microprocessors. The organization of a subsystem of memory in the personal computer the Basic features of RISC-processors. System of interruptions and exceptions. Types and characteristics of interfaces. Programming of work of separate blocks of microprocessor systems. Digital alarm processors (DSP). Tendencies of development of microprocessors.	5								v					v				
57	Designing cryptographic information security systems	The curriculum is aimed at acquainting students with the basic principles of designing cryptographic information security systems, using	5			v								v						

		methods of cryptographic information protection in the design and operation of information and communication technologies, managing cryptographic keys, generating, storing and distributing keys.																				
58	Intrusion Prevention Systems	Risks and channels of information leakage, classification of information security violators. Extended persistent threats. Data leakage protection technologies. Data Leakage Prevention (DLP) systems. Tasks of DLP systems, components of a data leakage prevention system. Classification of DLP systems, methods of detecting confidential information. Stages of DLP systems. Development of a data leakage prevention system. Analytical tools for incident investigation and analysis. IPC technologies, IPC tasks, components. Integration of DLP systems with IPC / IDS and SIEM systems.	5						v			v	v				v				
59	Standardization and certification of cryptographic tools	Development of standardization and certification in the field of information security.	5			v															

		Standardization and certification - prerequisites, goals and objectives. Conceptual model of information security. Theory and practice of standardization and certification in the field of information security. The development of a functional model of standardization and certification. General criteria for assessing the security of information technology. Problems and prospects for the development of standardization and certification. Technical specifications and regulatory standards for standards and certifications. Modern principles of standardization and certification.																			
60	Technical means and methods of information protection	Protection of information should ensure that Loss (theft, loss, distortion, forgery) of information in Any form of it. The organization of measures for the protection of information should be conducted In full compliance with applicable laws and regulations on information security, the interests of users of information. To guarantee a	5									v			v		v			

		high degree of information protection, it is necessary to constantly solve complex scientific and technical problems of developing and improving the means of its protection.																	

F KazNRTU 703-05 Educational program

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.M.Begentayev
« __ » ____ 2022 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year
Educational program 6B06301 "Information Security"
Group of educational programs B058 "IT security"

Form of study: full-time **Duration of training:** 4 years **Academic degree:** bachelor's degree in information and communication technologies

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		II course		III course		IV course	
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
M-1. Module of language training															
LNG108	Foreign language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG104	Kazakh (russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK101-104	Physical culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2				
M-3. Module of information technology															
CSE677	Information and communication technology	GED, RC	5	150	2/1/0	105	E			5					
M-4. Module of socio-cultural development															
HUM137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM132	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM120	Module of socio-political knowledge (sociology, political science)	GED, RC	3	90	1/0/1	60	E			3					
HUM134	Module of socio-political knowledge (cultural studies, psychology)	GED, RC	5	150	2/0/1	105	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	105	E				5				
MNG489	Fundamentals of economics and entrepreneurship				2/0/1										
CHE656	Ecology and life safety				2/0/1										
CYCLE OF BASIC DISCIPLINES (BD)															
M-6. Module of physical and mathematical training															
MAT101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5							
PHY111	Physics I	BD, UC	5	150	1/1/1	105	E	5							
MAT102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5						
PHY112	Physics II	BD, UC	5	150	1/1/1	105	E		5						
MAT103	Mathematics III	BD, UC	5	150	1/0/2	105	E			5					
M-7. Module of basic training															
SEC114	Introduction to specialty	BD, UC	5	150	2/1/0	105	E	5							
CSE536	Computer graphics	BD, UC	5	150	1/1/1	105	E						5		
ELC500	Microelectronics	BD, UC	5	150	2/1/0	105	E			5					
CSE603	Discrete mathematics	BD, UC	5	150	2/0/1	105	E			5					
SEC180	Digital circuitry	BD, UC	5	150	1/1/1	105	E					5			
CSE122	Computer networks	BD, UC	5	150	1/1/1	105	E					5			
SEC187	Digital Device Design	BD, UC	5	150	2/0/1	105	E					5			
CSE549	Architecture of computer systems	BD, UC	5	150	2/0/1	105	E							5	
CSE809	Designing and protecting server databases	BD, UC	5	150	2/1/0	105	E							5	
AAP179	Training Practice	BD, UC	2									2				
M-8. Programming module															
CSE554	Algorithmization and programming basics	BD, UC	4	120	1/1/1	75	E		4						
CSE564	Introduction to Web Programming	BD, UC	6	180	1/2/1	120	E			6					
CSE101	Java EE technology	BD, CCH	5	150	1/1/1	105	E					5			
CSE551	Capstone project 1				0/0/3										
M-9. Information protection and Security module															
SEC118	Information basis of information protection	BD, UC	5	150	2/0/1	105	E					5			
SEC100	Operating System Security	BD, UC	5	150	1/1/1	105	E					5			
SEC181	Basics of cryptographic protection of information	BD, UC	5	150	1/1/1	105	E						5		
CSE810	Designing secure Web-based applications	BD, CCH	4	120	1/1/1	75	E							4	
CSE552	Capstone project 2				0/0/3										
CSE807	Pentest Tools	BD, CCH	5	150	2/1/0	105	E							5	
CSE550	Vulnerability identification and analysis				2/1/0										
CYCLE OF PROFILE DISCIPLINES (PD)															
M-10. Professional activity module															
SEC189	Organization and securing databases	PD, UC	5	150	1/0/2	105	E					5			
SEC177	Blockchain technologies	BD, UC	5	150	1/1/1	105	E						5		
CSE546	Technologies of protection of computer information	PD, UC	4	120	2/0/1	75	E						4		
CSE545	Social engineering and ethical hacking	PD, UC	4	120	2/1/0	75	E						4		
SEC111	Securing cloud technologies	PD, UC	5	150	2/1/0	105	E								5
CSE548	Organizational and legal aspects of information security and computer forensics	PD, UC	4	120	1/0/2	75	E							4	
CSE806	Information security and object-oriented programming	PD, UC	5	150	1/1/1	105	E						5		
CSE547	Fundamentals of students' research work	PD, UC	4	120	1/0/2	75	E							4	
CSE805	Biometrics and neural networks	PD, UC	4	120	1/1/1	75	E								4
SEC185	Security of networking technologies	PD, CCH	5	150	2/1/0	105	E						5		
SEC199	Mathematics of cryptography				2/0/1										

Code	Discipline																
SEC151	The organization of microprocessor systems				1/1/1												
CSE411	System and Network Administration	PD, CCH	5	150	2/1/0	105	E								5		
SEC190	Cryptographic Information Security Systems				1/1/1												
SEC152	Microcontrollers				2/0/1												
SEC176	Intrusion Prevention Systems	PD, CCH	5	150	2/1/0	105	E										5
SEC169	Standardization and certification of cryptographic tools				2/0/1												
SEC142	Technical means and methods of information protection				2/0/1												
SEC175	Internet of things security	PD, CCH	5	150	2/1/0	105	E										5
SEC170	Designing cryptographic information security systems				1/1/1												
SEC166	Organization and management of information security service				2/0/1												
AAP192	Production practice I	PD, UC	2										2				
AAP193	Production practice II	PD, UC	3												3		
M-11. Module of final attestation																	
ECA108	Final certification	FC	8														8
M-12. Module of additional types of training																	
AAP500	Military affairs	ATT	0														
Total by UNIVERSITY:							32	28	31	29	30	30	33	27
							60		60		60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		97	14	176
PD	Cycle of profile disciplines		45	20	
	Total for theoretical training:	*51*	*142*	*39*	*232*
FC	Final attestation	8			8
	Total:	59	142	39	240

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 5 "24" november 2022 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 3 "17" november 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