MINISTRY OF SCIENCES AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

M.O. AUEZOV SOUTH KAZAKHSTAN UNIVERSITY

«APPROVED»
Chairman of the board -
Rector
Doctor of historical sciences,
Academician, Kozhamzharova D.P.
«__» _____ 2023

EDUCATIONAL PROGRAM

6B06140-«Mathematical and computer modeling»

Registration number	6B06100024
Code and classification of the field of education	6B06 Information and Communication Technologies
Code and classification of areas of study	6B061 Information and communication technologies
Group of educational programs	B057 Information technologies
Type of EP	acting
Level by IEQS	6
Level byNQF	6
Level bySQF	6
Language of instruction	Kazakh, Russian
Labor intensity of EP	240 credits
Distinctive features of the EP	-
Partner university (JEP)	-
Partner university (DDEP)	-

Shymkent, 2023

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The EP was considered in the direction of training information and communication technologies at a meeting of the academic committee, protocol № 7 « 21 » 02 2023y.

Chairman of the Committee _____ Shertayev E.T.
Signature

The EP was considered and recommended for approval at Educational-methodical meeting of M. Auezov SKU , protocol № 4 «22» 02 2023 y.

Chairman of the EMC _____ Abisheva R. D.

The EP was approved by the decision of the Academic Council of the University protocol № 13 «23» 02 2023 y.

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1. PROGRAM CONCEPT

Mission of the University	Generation of new competencies, training of a leader who translates research and entrepreneurial thinking and culture
University Values	• Openness–open to change, innovation and cooperation. • Creativity – generates ideas, develops them and turns them into values. • Academic freedom – free to choose, develop and act. • Partnership – creates trust and support in a relationship where everyone wins. • Social responsibility–ready to fulfill obligations, make decisions and be responsible for their results.
Graduate Model	• Deep subject knowledge, their application and continuous expansion in professional activity. • Information and digital literacy and mobility in a rapidly changing environment. • Research skills, creativity and emotional intelligence. • Entrepreneurship, independence and responsibility for their activities and well-being. • Global and national citizenship, tolerance to cultures and languages.
Uniqueness	• Orientation to the regional labor market and social order through the formation of professional competencies of the graduate, adjusted to meet the requirements of stakeholders. • Practical orientation and emphasis on the development of critical thinking and entrepreneurship, the formation of a wide range of skills that will allow you to be functionally literate and competitive in any life situation and be in demand in the labor market.
Academic Integrity and Ethics Policy	The University has taken measures to maintain academic integrity and academic freedom, protection from any kind of intolerance and discrimination: • Rules of academic integrity (Protocol of the Scientist from the ovet No. 3 dated 30.10.2018); • Anti-Corruption Standard (Order No. 373 n/a dated 27.12.2019). • Code of Ethics (Protocol of the Academic Council No. 8 dated 31.01.2020).
Regulatory and legal framework for the development of EP	1. The Law of the Republic of Kazakhstan "On Education"; 2. Standard rules of activity of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by Order of the Ministry of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595 with amendments and additions dated December 29, 2021 No. 614 3. State mandatory standards of higher and postgraduate education, approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan dated July 20, 2022 No. 2; 4. Rules for the organization of the educational process on credit technology of training, approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152;

	5. Qualification directory of positions of managers, specialists and other employees, approved by the Order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan on December 30, 2020 No. 553. 6. Guidelines for the use of ECTS. 7. Guidelines for the development of educational programs of higher and postgraduate education, Appendix 1 to the order of the Director of the Central Research Institute No. 45 o/d dated June 30, 2021. NCE RK "Atameken" - Order No. 330 of December 5, 2018).
Organization of the educational process	• Implementation of the principles of the Bologna Process • Student-centered learning • Availability • Inclusivity
Quality assurance of EP	• Internal quality assurance system • Involvement of stakeholders in the development of the OP and its evaluation • Systematic monitoring • Updating the content (updating)
Requirements for applicants	They are established according to the Standard Rules of admission to training in educational organizations implementing educational programs of higher and postgraduate education Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 600 dated 31.10.2018
Conditions for the implementation of EP for persons with disabilities and OOP	For students with OOP and LSI, tactile PVC tiles, specially equipped toilets, a mnemonic circuit, rods in shower rooms are installed in academic buildings and student dormitories. Special parking spaces have been created. A crawler lift is installed. There are desks for MGN, signs indicating the direction of movement, ramps. The academic buildings (*main building, No. 8 building*) are equipped with 2 classrooms with six workplaces adapted for users with disorders of the musculoskeletal system (ODE). For visually impaired users, there is a SARA™ CE machine (2 pcs.) for scanning and reading books. The library's website is adapted for the visually impaired. There is a special NVDA audio program with the service.The website of the ICHTTP://lib.ukgu.kz/ is open 24/7. An individual differentiated approach is provided for all types of classes and in the organization of the educational process.

2. PASSPORT EDUCATIONAL PROGRAM

Purpose of the EP	Training of highly qualified and in-demand specialists with critical thinking and advanced knowledge in the field of IT, capable of analyzing, forecasting, modeling and solving applied problems in accordance with the needs of society, the state and business.
EP tasks	- formation of socially responsible behavior in society,a high general intellectual level of development,mastery of literate language, multilingualism, culture of thinking,understanding the significance of professional ethical norms, research of these norms; -providing lifelong learning skills and abilities that will enable them to successfully adapt to changing conditions throughout their professional career; - formation of the competitiveness of graduates in the field of information and communication technologies to ensure the possibility of their fastest possible employment in the specialty or continuing education at subsequent stages of training; - - constant feedback from stakeholders and ensuring their requests.
Harmonization of EP	• 6th level of the National Qualifications Framework of the Republic of Kazakhstan; • Dublin descriptors of the 6th level of qualification; • 1 cycle of the Qualification Framework of the European Higher Education Area (A Framework for Qualification of the European Higher Education Area); • Level 6 of the European Qualification Framework for Lifelong Learning (TheEuropeanQualificationFrameworkforLifelongLearning).
Communication of the EP with the professional sphere	**Professional standard "Testing of Web and multimedia applications".** Appendix No. 36 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 24.12.2019y No. 259. **Professional standard: "Development of big data processing and storage systems".** Appendix No. 18 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. **Professional standard: "Software maintenance".** Appendix No. 20 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. **Professional standard of "Database Administration".** Appendix No. 1 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. **Professional standard: "Ensuring the security of information infrastructure and IT".** Appendix No. 4 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. **Professional standard: "Cloud technology development".** Appendix No. 19 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.
Name of the degree awarded	After successful completion of this OP, the graduate is awarded the degree: Bachelor in information and communication technologies in the

	educational program 6B06140-"Mathematical and computer modeling"
List of qualifications and positions	Primary positions:software maintenance specialist; database administration and management specialist; business analyst in the field of IT; mathematician-programmer, developer of mathematical and computer models; specialist in research institutions, design, design and other organizations without presenting work experience requirements in accordance with the qualification requirements of the National Classifier of the Republic of Kazakhstan (NCZ), approved by the order of the Committee for Technical Regulation and Metrology of the Ministry of Investment and Development of the Republic of Kazakhstan dated December 30, 2020 No. 553.
Field of professional activity	- public, private enterprises and organizations that develop mathematical and computer models, implement and operate information technologies in various fields of human activity. - research and design organizations that develop mathematical and computer models of various processes.
Objects of professional activity	- research, design, development, testing, implementation and maintenance of information and communication systems; - mathematical and computer modeling of natural-physical, chemical-technological and other processes.
Subjects of professional activity	Theoretical and practical knowledge in: mathematics-computer modeling of natural processes, conducting experiments of the computational process, software, linguistic, technical, organizational and legal support of mathematical and computer models.
Types of professional activity	- design and engineering; - scientific research; - estimated; - production and technological; - organizational and managerial; - operational.
Learning outcomes	**LO1** Communicate freely in the professional environment and society in Kazakh, Russian and English, taking into account the principles of academic writing and the culture of academic honesty. **LO2** Apply natural science, mathematical, social, socio-economic and engineering knowledge in professional activities, methods of mathematical data processing, scientific and experimental research, regulatory documents and elements of economic analysis. **LO3** Analyze and summarize information when building models, setting goals and choosing ways to achieve it. **LO4** Determine initial and boundary conditions, initial data, obtain and evaluate results in the process of mathematical and computer modeling. **LO5** Programming in the following environments: C++ - for resource–intensive technologies and problem solving on devices with minimal performance; Java EE, PHP - when developing interactive products for the Internet; iOS, Android, WP, Tisen - when developing mobile applications, planning and managing cloud resources, designing cloud solutions taking into account the business requirements of the organization. **LO6** Develop mathematical and computer models and their components in various fields using modern research methods, ensuring corporate

	interests and compliance with corporate ethics. **LO7** Plan and conduct experimental studies, process data with interpretation of the results obtained on the basis of modern modeling methods and computer technologies. **LO8** Administer information security tools in computer systems and networks, ensure the protection of information during their operation, select optimal methods of technical protection of information in the implementation of information processes on various devices, the introduction of information security systems in the IS. **LO9** Create projects by using the resources of mathematical and computer models with a preliminary feasibility study of design calculations. **LO10** Design and administer databases, including big data, taking into account modern methods, ensure the storage of big data, create software tools for data processing, manage information processes, maintain hardware and software complexes. **LO11** Be able to work effectively individually and as a team member, demonstrate self-education and self-education skills and lead a healthy lifestyle.

3. COMPETENCIES OF THE EP GRADUATE

GENERAL COMPETENCIES (SOFT SKILLS). Behavioral skills and personal qualities	
SS 1. Competence in managing your literacy	SS 1.1.The ability to self-study, self-develop and constantly update their knowledge within the chosen trajectory and in the conditions of interdisciplinarity. SS 1.2. The ability to express thoughts, feelings, facts and opinions in the professional sphere. SS 1.3. The ability to mobility in the modern world and critical thinking.
SS 2. Language competence	SS 2.1. Ability to build communication programs in the state, Russian and foreign languages. SS 2.2. The ability to interpersonal social and professional communication in the context of intercultural communication.
SS 3. Mathematical competence and competence in the field of science	SS 3.1. The ability and willingness to apply the educational potential, experience and personal qualities acquired during the study of mathematical, natural science, technical disciplines at the university, to solve professional tasks.
SS 4. Digital competence, technological literacy	SS 4.1. The ability to demonstrate and develop information literacy through the mastery and use of modern information and communication technologies in all spheres of your life and professional activity. SS 4.2.The ability to use various types of information and communication technologies: Internet resources, cloud and mobile services for the search, storage, protection and dissemination of information.
SS 5. Personal, social and educational competencies	SS 5.1. The ability to physical self-improvement and orientation to a healthy life for the provision of inferior social and professional activities through methods and means of physical culture. SS 5.2. The ability to socio-cultural development based on the manifestation of citizenship and morality. SS 5.3 The ability to build a personal educational trajectory throughout life for self-development, career growth and professional success. SS 5.4. The ability to successfully interact in a variety of socio-cultural contexts during study, at work, at home and at leisure.
SS 6. Entrepreneurial competence	SS 6.1. The ability to be creative and enterprising in different environments. SS 6.2. The ability to work in the mode of uncertainty and rapid change of task conditions, make decisions, allocate resources and manage your time. SS 6.3. The ability to work with consumer requests.
SS 7. Cultural awareness and self-expression	SS 7.1. The ability to show ideological, civic and moral positions. SS 7.2. The ability to be tolerant of the traditions and culture of other peoples of the world, to possess high spiritual qualities.
PROFESSIONAL COMPETENCIES (HARD SKILLS).	
Theoretical knowledge and practical skills specific to this field	HS1.– the ability to identify trends and prospects for the development of modern information technologies;
	HS2. – the ability to apply application programs to solve problems in the field of mathematical and computer modeling; to conduct numerical modeling; to analyze the results obtained; to check the adequacy of models; to make predictive solutions;
	HS3. – ability to develop complex algorithms; formulate a problem and apply methods of mathematical and system programming in research activities, in project management in specific areas of professional activity

	HS4. – the ability to perform work on the creation (modification) of web resources; to ensure the safe and uninterrupted operation of a web resource; to develop and manage software tools for automating big data processing
	HS5. – Ability to program using modern tools and technologies; test and debug software systems; monitor and upgrade software products; work with hardware and software complexes; integrate software modules and components.
	HS6. – The ability to solve all the questions related to the stages of the technological process, the safety of labor in production, the protection of the surrounding environment.

3.1 Matrix of correlation of learning outcomes on the EP as a whole with the competencies being formed

	LO 1	**LO2**	**LO3**	**LO4**	**LO5**	**LO6**	**LO7**	**LO8**	**LO9**	**LO 10**	**LO 11**
SS 1	+	+	+								
SS 2	+	+									
SS 3		+	+					+	+		
SS 4					+	+	+	+	+	+	
SS5											+
SS6			+	+							+
SS7	+										
HS1		+									
HS2				+			+				
HS3			+			+	+	+			
HS4					+			+		+	
HS5					+				+	+	
HS6	+	+									+

4. MATRIX OF THE INFLUENCE OF DISCIPLINES ON THE FORMATION OF LEARNING OUTCOMES AND INFORMATION ABOUT LABOR INTENSITY

№	Name of the module	cycle	component	Name of the discipline	Brief description of the discipline	Quantity Credits	Generated learning outcomes (codes)										
							LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11
1	Fundamentals of Social Sciences	GED	OC	History of Kazakhstan	Purpose: to form an objective view of the history of Kazakhstan based on a deep understanding and scientific analysis of the main stages, patterns, and peculiarities of the historical development of Kazakhstan. Contents: Ancient people and the formation of a nomadic civilization. The Turkic civilization and the Great Steppe. Kazakh Khanate. Kazakhstan in the era of modern times. Kazakhstan is part of the Soviet administrative and command system. Proclamation of independence of Kazakhstan. The state system, socio-political development, foreign policy and international relations. Methods and techniques of historical description for analyzing the causes and consequences of events in the history of Kazakhstan.	5	v										v
		GED	OC	Philosophy	Purpose: Formation of students' holistic understanding of philosophy as a special form of cognition of the world, its main sections, problems and methods of their study in the context of future professional activity. Formation of students' philosophical reflection, self-analysis skills and moral self-regulation. Content: The emergence of a culture of thinking. The subject and method of philosophy. Fundamentals of philosophical understanding of the world: questions of consciousness, spirit and language. Genesis. Ontology and metaphysics. Cognition and creativity. Education, science, technology and technology. Human philosophy and the world of values. Ethics. The philosophy of values. The subject of aesthetics as a field of philosophical knowledge. The philosophy of freedom. Philosophy of art. Society and culture. Philosophy of history. Philosophy of religion. "Mangilik El" and "Modernization of public consciousness" is a new Kazakh philosophy.	5	v										v
2	Socio-political knowledge	GED	OC	Sociology and Political Science	Purpose: formation of knowledge about socio-political activity, explanation of socio-political processes and phenomena. Content: Social and ethical values of societies. Features of social, political, cultural, psychological institutions in the context of their role in the modernization of Kazakh society. Making decisions to resolve conflict situations in society, including in professional society. Political institutions and processes, methods of analysis and interpretation of ideas about politics, government, the state and civil society. Methods and techniques of sociological, comparative analysis.	4	v										v

					The essence and content of the political situation in the modern world. Analysis and classification of the main political institutions.												
		GED	OC	Cultural studies and psychology	Purpose: Formation of scientific knowledge of history, modern trends, current problems and methods of development of culture and psychology, skills of system analysis of psychological phenomena. Contents: Morphology, language, semiotics, anatomy of culture. Culture of Nomads, Proto-Turks, Turks. Medieval culture of Central Asia. Kazakh culture at the turn of the XVIII – XIX centuries, XX century. Cultural policy of Kazakhstan. The State Program "Cultural Heritage". National consciousness, motivation. Emotions, intelligence. Human will, psychology of self-regulation. Individual typological features. Values, interests, norms are the spiritual basis. The meaning of life, professional self-determination, health. Communication of individuals and groups. Socio-psychological conflict. Models of behavior in conflict.	4	v											v
3	Socio-ethnic development	GED	UC	Ecosystem and law	Purpose: Formation of integrated knowledge in the field of economics, law, anti-corruption culture, ecology and life safety, entrepreneurship, methods of scientific research. Contents: Fundamentals of safe interaction between man and nature, productivity of ecosystems and the biosphere. Entrepreneurial activity in conditions of limited resources, increasing the competitiveness of business and the national economy. Regulation of relations in the field of ecology and human life safety. Knowledge and observance of Kazakhstan's law, obligations and guarantees of subjects, state regulation of public relations to ensure social progress. Application of scientific research methods.	5	v											v
		BD	EC	Actual problems and modernization of public consciousness	Purpose: to restore spirituality deformed during the tsarist and Soviet periods, to form a creative personality based on the modernization of the social consciousness of young people. Contents: Spiritual modernization: origin and prerequisites. Modern national identity. Pragmatism and competitiveness. National identity and national code. Experience and prospects of evolutionary development. The triumph of knowledge and openness of consciousness. Alphabet reform: experience and priorities. The motherland is the foundation of the state. Education through national sacred places and history. Modern Kazakh culture is the cornerstone of spiritual revival. New humanitarian education and the future national intelligentsia. Abai Kunanbayev and the Kazakh society.	3		v										
		BD	EC	Mukhtar study	Purpose: formation of historical, literary presentation on the work of M. Auezova in the context of history of literature, patriotism and cultural-spiritual position. Development of healthy mousetraps, self-sufficient research activities. "I don't know," he said, " but I don't know." Activity of M. Auezova in			v									

					the magazines "Sholpan", "Abay". Journalism M. Auezova. The main focus of Rasskazov is "day of the defenseless", "pictures of kyr", "read citizen", "Kokserek",the play Enlik-Kebek and the story "Kili Zaman", "The Story of Karash-Karash", the monograph" Abay Kunanbayev", the novel - epic" the way of Abay".												
		BD	EC	Abay study	Purpose: Preservation of the "national code" in the project "Kazakhtanu" based on the creativity of A. Kunanbayev Contents: historical overview of the history of Kazakhstan and Kazakh literature of the XIX-XX centuries. Studies of Abai's legacy of the XX-XXI century. Chronology of Abai's creativity. Abai is a great poet, ethnographer, founder of Kazakh written literature. Abai is the compiler of the code of laws "The Position of Karamola", social significance. Abai is a thinker, religious scholar, philosopher. The role of Abai in education and science, the concept of a "Holistic person". "Words of Edification" by Abai, an epic novel by M.Auyezova "The Way of Abai". K. Tokayev "Abai and Kazakhstan in the XXI century", role, significance.			v									
		BD	EC	Service to society	Purpose: formation of socially significant skills and competencies among students based on the assimilation of academic programs, carrying out socially useful activities related to the disciplines studied at the university. Content: The concept and meaning of Service learning, the history of the formation and development of the concept of Service Learning. The key components of Service Learning, socially useful activities in children and youth, the organization of the volunteer movement in the world and Kazakhstan practice, the profile orientation of Service Learning. International practice of learning through socially useful activities. General principles and methodology for the development of social projects. Methods of analysis of implemented social projects.		v										v
		BD	EC	Fundamentals of anti-corruption culture	Purpose: Formation of an anti-corruption worldview, strong moral foundations of personality, civic position, stable skills of anti-corruption behavior. Content: Overcoming legal nihilism, the foundations of legal culture in the field of anti-corruption legislation. Conscious perception, attitudes to corruption. Moral rejection of corrupt behavior, corrupt morality, ethics. Mastering the skills necessary to counter corruption. Creating an anti-corruption standard of conduct. Anti-corruption propaganda, dissemination of ideas of legality, respect for the law. Activities aimed at understanding the nature of corruption, awareness of social losses from its manifestations, the ability to defend one's position in a reasoned manner, to look for ways to overcome manifestations of corruption.		v										v

4	Communication and Physical Education Module	GED	OC	Kazakh (Russian) language	Purpose: Formation of communicative competence using the Kazakh (Russian) language in the socio-cultural, professional and public life, improving the ability to write academic texts. Content: Levels A1, A2, B1, B2-1, B2-2 (B2, C1 Russian) are presented in the form of cognitive-linguistic-cultural complexes consisting of spheres, topics, subtemes and typical communication situations of international standard: social, social, cultural, educational and professional, modeled forms: oral and written communication, written speech works, listening. Demonstration of understanding of the language material in the texts of the educational program, possession of terminology and development of critical thinking.	10	v										
		GED	OC	Foreign language	Purpose: the formation of intercultural and communicative competence of students in the process of foreign language education at a sufficient level A2 and the level of basic sufficiency B1. The student reaches the B2 level of the pan-European competence if there is a language level at the start above the B1 level of the pan-European competence Content: Levels A1, A2, B1, B2 are presented in the form of cognitive - linguoculturological complexes consisting of spheres, topics, subtemes and typical situations of communication of international standard: social and household, socio-cultural, educational and professional, modeled forms: oral and written communication, written speech works, listening. Demonstration of understanding of the language material in the texts of the educational program, possession of terminology and the development of critical thinking.	10	v										v
		GED	OC	Physical Culture	Purpose: Formation of social and personal competencies and the ability to purposefully use the means and methods of physical culture that ensure the preservation and strengthening of health for preparation for professional activity; for the persistent transfer of physical exertion, neuropsychic stresses and adverse factors in future work. Content: Implementation of physical culture and health and training programs. A complex of general development and special exercises. Sports (gymnastics, sports and outdoor games, athletics, etc.). Control and self-control during classes, insurance and self-insurance. Judging competitions. Means of professionally applied physical training. Modern health-improving systems: breathing system according to A. Strelnikova, K. Buteyko, K. Dinaiki, joint gymnastics according to Bubnovsky.	8											v
		BD	UC	Professional Kazakh (Russian) language	Purpose: Development of students' communicative competence for the implementation of professional speech activity. Content: The concept of "professional Kazakh/Russian language and professional culture of speech" and the scope of its use. Functional types of professional speech. Norms in professional speech.	3	v										v

					Professional vocabulary and professional jargon. The terminological system of the Kazakh/Russian language. The problem of translating terms. Word-forming elements of terminological vocabulary. The norm in terminology. International terminology. .Special text. The main genres of scientific and professional texts: abstract, abstract, review. Speech culture and features of speech behavior in the professional sphere. Richness and expressiveness of speech. Professional ethics and etiquette of speech behavior.												
		BD	UC	Professionally-oriented foreign language	Purpose: Formation of professionally oriented communicative competencies among students that allow them to integrate into the international professional environment and use professional English as a means of intercultural and professional communication Content: Fundamentals of professional language in the specialty. The structure of sentences, a thematic group of words in their specialty. Editing business documents. Use of Internet and e-mail services. Selection of literary sources for performing communicative tasks. Preparation of messages, articles, abstracts on professional topics. Dialogue on professional and business topics.	3	v		v		v					v	
		GED	OC	Information and communication technologies	Purpose: Formation of the ability to critically evaluate and analyze processes, methods of searching, storing and processing information, methods of collecting and transmitting information through digital technologies. Development of new "digital" thinking, acquisition of knowledge and skills of using modern information and communication technologies in various activities. Contents: Introduction and architecture of computer systems. Software. Operating systems. Human interaction with computers. Database systems. Database management. Networks and telecommunications. Cyber defense. Internet technologies. Cloud and mobile technologies. Multimedia technologies. Smart technologies. Electronic technologies. Electronic business. Electronic control.	5	v										v
5	Natural science fundamentals of the specialty	BD	UC	Physics	Purpose: Formation of knowledge of physical laws and skills of their application in engineering and computer technology, development of skills for conducting and evaluating the results of theoretical and experimental research, development of scientific thinking based on an interdisciplinary approach. Contents: Laws of classical and modern physics (mechanics, molecular physics, thermodynamics, electromagnetism, optics, quantum and atomic physics). Application of knowledge of physical phenomena and processes to solve applied, technical and technological problems based on an interdisciplinary approach. Scientific research methods, methods of planning, conducting, processing and analyzing the results of theoretical and experimental research.	5		v	v			v	v				

		BD	UC	Algebra and Geometry	Purpose: Formation of students' skills in solving algebra and geometry problems and their application in other mathematical disciplines and professional activities. Content: The field of complex numbers. Operations on complex numbers given in trigonometric form. Linear operations on matrices. The inverse matrix. The determinant of a square matrix and their simplest properties. Solving systems of linear algebraic equations by the Kramer method, matrix multiplication. The Kronecker-Capelli theorem. The ring of polynomials. Division of polynomials with remainder. Euclid's algorithm. Linear operations on vectors. Scalar, vector, mixed product of vectors. Various equations of a straight line on a plane. Equations of planes. Lines of the second order. Surfaces of the second order.	4		v	v	v							
		BD	UC	Mathematical analysis I	Purpose: To develop logical thinking and mathematical culture of students necessary for studying other mathematical disciplines. Contents: Set theory. Real numbers and working on them. The concept of function. The scope of the function definition and values. Plotting the function. Types of functions. Numerical sequences. Determination of the limit of the sequence and function. Theorems about the limits of a function. Limit of a monotone function. Definition and continuity properties of the function. Arithmetic operations on continuous functions. Continuity of elementary functions. Definition of the product of the function. Table of derivatives. Differential. Basic formulas and rules of differentiation. Invariance of the differential form. Higher-order derivatives. The Leibniz formula. Higher-order differentials. Fermat's theorem. Approximation formulas. The study of functions using a derivative.	4		v		v					v		
		BD	EC	Introduction to the specialty	Purpose: Formation of students' ideas about the future specialty, development prospects and features of professional training in the specialty. Content: The main aspects of professional training of future specialists in the system of higher professional education. Object and model. Classification of modeling methods. Stages of mathematical modeling. The essence of computer modeling. Areas of application of mathematical and computer modeling methods. The use of information resources and software and hardware in education. Working with Internet resources. Work with literature and regulatory documents. Features of distance learning. Methods and technologies.	4		v	v	v				v			

		BD	EC	Fundamentals of Academic Writing	Purpose: To develop the skills of independent research work to create a text in a selected scientific genre. Content: To develop skills and abilities to make a plan of the research text; to write an abstract, a research abstract; to make a review of the literature used in a scientific project; to quote competently, avoid plagiarism; to use statistical data in your written work, including graphically presented; to edit what is written; to compile bibliographic lists; to make a presentation of your own project; to conduct business correspondence		v	v									v
6	Mathematical and computer fundamentals of the specialty	BD	EC	Mathematical analysis II	Purpose: To form students' fundamental concepts of mathematical analysis, to develop skills in solving and applying improper integrals. Contents: Concepts of an improper integral of the first kind and its convergence. Improper integrals of the second kind and its convergence criterion. Reduction of an improper integral of the second kind to an improper integral of the first kind. Integrals depending on the parameter. Euler integrals as examples of non-elementary functions. Closed and complete orthonormal systems in Euclidean space. The simplest conditions for uniform convergence and slow differentiation of the trigonometric Fourier series. The double Riemann integral on a rectangle for an arbitrary area. Reduction of a double integral to a repeated one-time integral. The Riemann integral on an n-dimensional rectangular parallelepiped and on an arbitrary domain. Improper multiple integrals.	4		v	v	v							
		BD	EC	Surface integrals	Purpose: To form students' knowledge about double, improper multiple integrals and skills of their calculations. Content: The concept of a double integral. Concepts of repeated integrals. Green's formula. Independence of the curvilinear integral from the integration curve. Substitution of variables in the double integral. Finding the area of a curved surface. Improper double integral of the second kind. The property of the transition of an improper integral of the second kind to a double improper integral of the first kind. Mechanical and physical applications of double integrals. Calculation of the n-fold integral. The physical meaning of curvilinear integrals of the first and second kind and their definitions. The surface in . Normal and tangent plane to the surface. Physical problems leading to surface integrals of the first kind.			v	v	v							
		BD	EC	Differential equations	Purpose: Formation of students' skills in solving differential equations and systems of differential equations, using them to solve applied problems of physics, mechanics and engineering. Contents: Ordinary differential equations of the first order. Higher-order differential equations. General theory of systems of linear differential equations. Linear differential equations of the nth order with constant coefficients. Dynamical systems and stability theory.	5		v		v		v				v	

					Linear partial differential equations of the first order. Mathematical modeling by differential equations of applied problems of physics, engineering. Methods for solving equations resolved with respect to the derivative. Continuous dependence of the solution on the initial data and parameters.												
		BD	EC	Differential equations in mathematical models	Purpose: To develop skills in describing physical, chemical, economic processes and phenomena using differential equations. Content: Statement of the main types of problems of mathematical physics. Models based on differential equations and systems. Properties of simulated processes for various types of partial differential equation problems. Analysis and verification of the adequacy of the solutions obtained. Interpretation of decisions.			v		v		v				v	
		BD	UC	Algorithmization and programming	Purpose: Acquisition of practical knowledge on algorithm development, mastering by students of methods and technologies for solving practical and scientific problems in Python. Contents: PC software. The concept of an algorithm. Basic structures of algorithms. Methods of describing algorithms. Linear structure algorithms. Branching structure algorithms. Cyclic structure algorithms. Expressions and assignments. Python language operations. Linear structure programs. Branching structure programs. The for operator. The while operator. Lists. Lines. Tuples. Working with the function. Recursion. Two-dimensional arrays. Sets. Dictionaries. Modules. Working with files. Graphics.	5		v	v		v		v			v	
		BD	UC	Object-oriented programming	Purpose: To develop skills in the Visual C# object-oriented programming environment. Contents: Basics of the Visual C# language. The alphabet of the language. Data types and standard functions. Visual C# language operators. Linear programming in Visual C#. Conditional operator. Contractual operations. Switch and break operators. Types of cyclic operators. Processing of array elements. Object-oriented programming. Objects and classes. Encapsulation of object properties. Inheritance. Polymorphism. Interface. Working with the menu. Working with the project. Editing the code. Components that create an interface between the user and the application. Creating a database. Components that work with databases. Creating a graphic editor application in the Visual C# environment. BDE technology.	5			v		v		v			v	
		BD	EC	Application of IT in mathematics	Purpose: Formation of knowledge, skills, and skills for solving a wide class of mathematical problems and computer modeling capabilities using the Mathcad Prime package. Contents: Basic techniques of working in the Mathcad Prime environment. Using matrix functions and operators in the Mathcad Prime environment. Symbolic calculations in the Mathcad Prime environment. Calculation of derivatives, integrals and matrices.	4			v		v		v			v	

					Symbolic calculations with matrices. Solving systems of linear equations in Mathcad. Solving a system of linear equations using the lsolve function. Optimization functions in the Mathcad Prime environment. Examples of using curve approximation and smoothing functions. Programming in the Mathcad Prime environment. Plotting functions in Mathcad.													
		BD	EC	Applied computing in Matlab	Purpose: To acquire practical knowledge, skills, and skills for solving applied problems using the integrated MATLAB software package. Content: Matlab interface. Principles of working in the Matlab environment. Application of functions and operators in the Matlab software package. Performing symbolic calculations in the Matlab environment. Working with matrices in the Matlab environment. Methods for calculating integrals and derivatives. SLOUGH's solution in the Matlab environment. Solving optimization problems using the Matlab package. Programming in the Matlab environment. Graphical capabilities of the integrated Matlab software package. Organization of program constructions using program control operators. Design of MATLAB modules in the form of script files and function files.				**v**		**v**		**v**				**v**	
		BD	UC	Educational practice	Purpose: To consolidate practical skills in algorithm development and programming in a high-level language. Content: Expansion and deepening of the acquired theoretical knowledge on the development of algorithms and programs; acquisition of initial practical skills and competencies in the field of professional activity, in solving specific problems.	1												
7	Mathematical and computer modeling of processes	PD	EC	Fundamentals of mathematical modeling	Objective: To acquire skills in implementing models of processes of different nature and establishing their results of adequacy to the process under study. Contents: Classification of mathematical models. The semantics of the problem statement. The basic principles of creating mathematical models. The use of fundamental laws of natural science as the basis of mathematical modeling. Analytical models. Statistical models. Deterministic and stochastic models. Methods and features of mathematical modeling of various processes. Stages of modeling. Methods of implementation of mathematical models: analytical, approximate-analytical and numerical methods. Methodology of selection and use of sections of the mathematical apparatus in mathematical modeling. Methods of establishing the adequacy of mathematical models.	5				**v**		**v**	**v**	**v**			
		PD	EC	Deterministic mathematical models of processes	Purpose: Formation of students' skills in mathematical modeling based on analytical representations for the main parameters of processes. Content: Stages of mathematical modeling. Classification of mathematical models. The basic principles of creating mathematical models. The use of fundamental laws of natural science as the basis of			**v**	**v**				**v**	**v**			

					mathematical modeling. Methodology for implementing deterministic models. Finding intermediate parameter values in the presence of accurate experimental data. Error in the implementation of deterministic models. Convergence, accuracy and stability of model implementation methods. There are two main methods of computer implementation of models: the use of a user program and application software packages. Methods of establishing the adequacy of mathematical models.											
		BD	EC	Economic and mathematical modeling	Purpose: To develop skills in the development and use of economic and mathematical models in enterprises and organizations. Contents: Fundamentals of economic and mathematical modeling. Models and modeling goals. Classification of models. Ultimate analysis and optimization. Fundamentals of setting and solving optimization problems. Practical implementation of optimization tasks. Production functions. Types of production functions, construction and forecasting. Stochastic programming models. The concept of stochastic programming. Types of stochastic models. Economic and statistical modeling. Correlation analysis of data. Regression analysis. Theory of matrix games. Basic concepts of game theory. Classification of games. Simulation modeling of economic systems. Network planning using the statistical testing method (Monte Carlo). Models of queuing systems.	4		**v**				**v**			**v**	**v**	
		BD	EC	Data analysis in economic systems	Purpose: To acquire theoretical knowledge about modern principles, methods and means of data analysis, practical skills and abilities to apply modern methods of data analysis in various spheres of human activity. Content: Working with information from various sources, including in global computer networks, analyzing innovations in economics, management and information and communication technologies. Mathematical apparatus and tools for processing, analyzing and systematizing information on the research topic. Problematic issues of the introduction of analytical software products and technologies in the professional activities of organizations and institutions. Application of methods of transformation, visualization, quality assessment, data purification and preprocessing for qualitative data preparation for analysis.			**v**				**v**			**v**	**v**	
		PD	EC	Mathematical and computer modeling of physical processes	Purpose: Formation of practical skills in modeling and implementation of specific physical processes. Contents: Computer mathematical systems. Classification of differential equations. Boundary conditions. Simulation of diffusion problems. Creation of mathematical models of environmental problems. Implementation of models in computer systems. Dispersed systems in nature and production, their mathematical description.	5		**v**		**v**		**v**			**v**		**v**

					Examples of mathematical modeling of complex objects. Models of fluid and gas motion. Ocean model. Layered movements. Mathematical modeling of weather. Equations of equilibrium of liquid and gas and their integration. The basic law of hydrostatics. The equilibrium of the Earth's atmosphere. Vortex movements.												
		PD	EC	Theory of dynamical systems	Purpose: Formation of knowledge and skills in modeling dynamic systems and methods of model implementation. Contents: Fundamentals of the theory of dynamical systems. Computer mathematical systems. Classification of differential equations. Boundary conditions. Phase spaces. Phase flows. An evolutionary equation with a one-dimensional phase space. The equation of normal reproduction. The explosion equation. The logistic curve. Creation of mathematical models of environmental problems. Implementation of models in computer systems. Small fluctuations. Mathematical pendulum. Autonomous systems. Phase curves of an autonomous system. Dispersed systems in nature and production, their mathematical description. Examples of mathematical modeling of complex systems. Models of fluid and gas motion.						**v**			**v**		
		PD	EC	Mathematical and computer modeling of technological processes	Purpose: Formation of students' skills in mathematical modeling of basic technological processes. Contents: Modeling of hydrodynamics and heat and mass transfer in technological devices. Classification of laws on the rate of chemical reactions. The basic principles of creating mathematical models of technological processes. The use of fundamental laws of physics and chemistry as the basis of mathematical modeling of technological processes. Evaluation of the field of application of mathematical models – determination of universality and effectiveness. Examples of the application of the acquired knowledge in mathematical modeling in chemical technology. Methods of proving the adequacy of mathematical models. Methods of constructing the program code of mathematical models in an algorithmic language. Implementation of models using standard programming packages.	5		**v**		**v**		**v**					
		PD	EC	Modeling of gas and liquid interaction in technological devices	Purpose: Formation of students' skills in modeling processes with the interaction of gas and liquid in technological devices. Contents: Classification of technological devices for the organization of gas and liquid contact. The main hydrodynamic, regime and heat and mass transfer characteristics of flows in apparatuses. Mathematical modeling of the processes of the gas-liquid system based on the Navier-Stokes equations. Simulation of gas dynamics in laminar mode in a contact device. Dynamics of dispersed systems. Fundamentals of modeling the dynamics of gases in a turbulent regime. Features of mass transfer in the gas-liquid system. Interaction of gas and liquid droplets in a contact device. Methods of establishing the adequacy of			**v**		**v**			**v**				

					the mathematical model of the CTP.												
8	Special courses on numerical methods	BD	EC	Numerical methods fo solving ordinary differential equations	Purpose: To master the basic numerical methods for solving ordinary differential equations, to form knowledge for solving differential equations and systems in problems of natural science. Contents: Classification of methods for solving ordinary differential equations by numerical methods. Approximation method. Operators for solving differential equations in the MatLab software package. Solution by explicit and implicit Euler methods. Solvers. The solution of ordinary differential equations of the first order by the Runge-Kutta method. Solving differential equations by the Runge-Kutta method using the Ode45 solver. The Adams method. Solving differential equations using the Code 13s solver. The Adams-Moulton method. Solving differential equations using Ode 115 and other solvers. Boundary value problems for ordinary differential equations. Difference scheme and difference functions. The general structure of the solution of inhomogeneous equations. Lagrange method in constant variation.	5		**v**		**v**		**v**				**v**	
		BD	EC	Numerical methods of analysis and algebra	Purpose: Formation of students' skills in the application of basic numerical methods of algebra and mathematical analysis and algorithms implementing them in the implementation of mathematical models. Contents: Numerical solution and analysis of algebraic problems. Methods for verifying the correctness of numerical methods. Exact and iterative methods for solving linear, algebraic and transcendental equations. Interpolation of functions, approximate calculation of integrals, basic concepts of the theory of difference schemes, numerical methods for solving problems for simple differential equations.			**v**		**v**		**v**				**v**	
		BD	EC	Numerical algorithms for solving partial differential equations	Purpose: To develop students' skills in compiling numerical algorithms for solving partial differential equations and methods for implementing them using computer technology. Contents: Classification of partial differential equations. Formulation of initial and initial boundary value problems. Numerical methods for solving parabolic type equations, Laplace and Poisson equations. Numerical algorithms for solving the equation of string vibration and wave propagation. Analytical and numerical methods for solving the Navier-Stokes equations. Convergence, accuracy, error and stability of numerical algorithms for solving partial differential equations. Examples of the implementation of numerical algorithms using application software packages and user programs.	4		**v**		**v**		**v**					
		BD	EC	Approximate analytical methods	Purpose: Formation of students' knowledge and skills on the application of approximate analytical methods for solving differential			**v**		**v**		**v**				**v**	**v**

				for solving equations of mathematical physics	equations of mathematical physics and their implementation using computer technology. Contents: Classification of equations of elliptic, parabolic, hyperbolic types and methods of their solution. Approximate solution of initial boundary value problems for the heat equation. The simplest approximate analytical solutions of the Navier-Stokes equations. Methods of decomposition into Taylor and Fourier series. Fast and discrete Fourier transforms and their practical use. Establishing the convergence of functional series for solutions in different geometrically shaped solution domains. Estimation of the error of approximate analytical methods for solving equations of mathematical physics.												
9	Scientific research and development of web services	PD	UC	Scientific research in the field of mathematical and computer processing of experimental data	Purpose: To develop the skills of mathematical and computer processing of experimental data during scientific research. Content: Simple ways to present the results of field and numerical experiments. Planning an experiment with small and large numbers of factors. A complete factorial experiment of type 2k. Drawing up a matrix of experiments. Univariate and multifactorial communication analysis. Evaluation and accounting of the experimental error and the method of processing the results. The least squares method for minimizing the error of empirical functions. Random variables, distribution function, statistical estimation of parameters. Compilation of the correlation equation. Estimation of the correlation coefficient. Methods for establishing the adequacy of models compiled on the basis of experimental data.	4		**v**		**v**		**v**	**v**				
		PD	UC	Simulation modeling of dynamic systems and processes	Purpose: Formation of students' practical skills in applying methods and models of simulation of dynamic systems and processes for making and implementing management decisions Content: Definition of simulation modeling. Areas of application of simulation modeling. Advantages and disadvantages of simulation modeling. Static and dynamic simulation models. Continuous and discrete simulation models. Construction and construction of the model and components. Simulation modeling of the dynamics of socio-economic systems. Representation of the structure and dynamics of the simulated system in a simulation model. Introduction to the AnyLogic system. The stage of designing and describing the model. Types of time representation in the model. Time change in constant increments. The advancement of time by special states. Model time management. Analysis of the results of the experiment.			**v**							**v**	**v**	

		PD	EC	Network technologies	Purpose: To develop skills in modern integrated programming systems for analyzing the principles of organization, construction and functioning of a computer network, microprocessors, network architecture, network protocols, principles of addressing and programming. Content: Application of the basic laws and rules of network technology: OSI model, protocol stack. Client-server, Peer-To-Peer and hybrid networks. Middleware. Terminals and remote control. Shared access to resources. Directory service. Database servers. Unification of interfaces to databases. Application servers. Web services. Fundamentals of security in computer networks. Prospects for the development of network technologies.	5			v		v				v	v	
		PD	EC	Network operating systems	Purpose: Formation of students' stable knowledge on the organization and functioning of computer operating systems, the peculiarities of the functioning of personal computers in the network, the acquisition of skills to work in network operating systems Contents: Network operating systems. The structure of the network operating system. Peer to Peer Network and dedicated servers. OS for operating groups and corporate networks. The Microsoft OS family. Microsoft products. Windows log. Windows versions. Scope of application for Windows. Windows NT concepts. Structure: executive and protected NT subsystems. Many application environments. Object-oriented approach. Network tools. Compatible with Windows NT with NetWare UNIX operating system.				v		v				v	v	
		PD	EC	Mobile application development	Purpose: Formation of practical skills in software development and user interface for mobile devices. Content: Workspace for Android OS application development. Installing and configuring the SDK. Creating the first application for Android OS. Application lifecycle stages and their structure. The program manifesto and external resources. The main user interface elements available. Working with files, databases, user settings, shared data and inter-program interaction. Designing specific mobile applications.	5					v					v	
		PD	EC	Cloud computing technologies in business	Purpose: To develop skills in the use of modern cloud computing technologies in professional activities. Content: General concepts of cloud technologies. Cloud solutions. Fundamentals of cloud computing. Cloud services provided by companies. Electronic presentation and GOOGLE spreadsheets for networking. Computing in the cloud in JAVA. Academic cloud service. Creating a private cloud. Installing OWNCLOUD cloud storage on a local web server. Access to the cloud from a local network in a domain created on an Open Server. Virtualization technologies. Virtualization platforms. Virtual machines. Configuring						v					v	

					Hyper-V WINDOWS SERVER.												
		PD	UC	Web Services Development (Java EE)	Purpose: Formation of skills for the application of modern methods of programming WWW applications on the Java EE platform. Contents: Introduction to WEB programming. Basics of server technologies. Server-side programming languages and development environments. Development of database-based applications. Client technologies of WEB programming: HTML, JavaScript, CSS. The modern WWW application model. CMS control systems. WEB services. Cloud technologies. Overview of modern SEO (search engine optimization) methods to improve the promotion of developed websites and Web applications on the Internet.	6											
		PD	UC	Industrial practice II	Purpose: Formation of skills for drawing up mathematical models of processes of different nature based on fundamental laws and experimental data. Content: Problem statements of the simulated process with additional conditions (semantics). The choice of mathematical apparatus for modeling processes. Development of a model with additional conditions and assumptions. Drawing up an algorithm for implementing a mathematical model. Development of a user program and a package of computer programs. The operation of a computer program and the establishment of the adequacy of the mathematical model. Preparation of reports.	6			**v**		**v**						
10	Basics of programming and databases	BD	EC	Java programming language	Purpose: Formation of students' programming skills in the high-level Java language. Contents: Introduction to the Java programming system. The composition of the programming system, the elements of the language. Data types. Ads. Expressions and assignments. Java language operations. Java language operators. Development of a linear structure program. Conditional if statement. The switch variant operator. Development of a branching structure program. The for operator. The while operator. The do while operator. One-dimensional arrays. Two-dimensional arrays. Working with strings. String class. Graphics. Development of programs using graphical functions. Class and object creation. Static methods in Java. Packages and interfaces. Working with files	4			**v**		**v**				**v**	**v**	
		BD	EC	Distributed systems in Java	Purpose: Formation of knowledge and ideas in the field of distributed systems for information processing and the peculiarities of using the high-level Java language in the Eclipse environment. Contents: Introduction to distributed systems. The concept of a distributed system. Hardware and software tools for building distributed systems. Protocol levels. Communication in distributed systems. Customers. Servers. Means of modern operating systems.				**v**		**v**				**v**	**v**	

					Application isolation. Mechanisms of synchronization of processes. Named entities. Placement of mobile entities. Time synchronization in distributed systems. Clock synchronization. Mutual exclusion. Basic and additional principles of creation and functioning of distributed systems. Customer-oriented consistency models. Distribution protocols. Consistency protocols. Fault tolerance of processes. Distributed file systems. The NFS file system. Trends in the field of distributed systems. Unsolved and promising problems of theory and practice of distributed systems. Directions of research.												
		BD	EC	Programming technology	Purpose: To develop theoretical knowledge and skills in programming in C++. Contents: Fundamentals of programming technology. Introduction to the programming system. Expressions and assignments. Language operators. Conditional operator. Loop operators. Operator with a precondition. Operator with a postcondition. Operator with a parameter. One-dimensional arrays. Two-dimensional arrays. Functions. Processing of symbolic information. Lines. Graphics. Programming of data structure processing tasks. Files. Memory classes. Automatic, static, external, register variables. Examples of the use of modular programming in solving complex problems.	5					**v**					**v**	
		BD	EC	Basics of C# programming	Purpose: Students acquire programming skills in C#. Contents: Basics of the C# language. General concepts. The alphabet of the C language is simple objects of the language. C# language operators. Linear programming in the C# environment. Conditional operator. Switch and break operators. Cyclic While operator, cyclic for operator. A cyclic operator of the Do type..While. processing of array elements. Processing elements of a two-dimensional array. Object-oriented programming. Objects and classes. Encapsulation of object properties. Inheritance. Polymorphism. Interface. Working with the menu. creating a new project. Modification of an existing project. Opening of the project. Working with the project. The Object Inspector window. Code editor. Form constructor. The palette of components. Features. Events. Methods. Components that create an interface between the User and the application.				**v**		**v**					**v**	**v**	**v**
		PD	UC	Database management systems	Purpose: To develop skills in practical database design and building information applications using modern DBMS on various hardware platforms in various subject areas. Content: Principles of building database systems. Data representation models. Basic operations on data. Basics of database design. Designing an information model for subject areas. Data processing in modern DBMS. Representation of data using various models. Practical database design and construction of information applications using	5			**v**		**v**					**v**	**v**	**v**

					modern DBMS.													
		PD	UC	Industrial practice I	Purpose: Formation of skills for solving typical problems of mathematics by analytical and numerical methods. Contents: Development of analytical and numerical methods for solving linear and nonlinear equations and their systems. Development of numerical algorithms for calculating integrals. Processing of experimental data. Graphic design methods data representations. Using a package of application programs to solve problems. Solving professional tasks related to the activities of the practice bases.	4									**v**	**v**	**v**
11	Graphical tools in modeling and information protection	BD	EC	3 3D modeling	Purpose: To develop practical skills of working in the environment of the AutoCAD graphic editor for modeling three-dimensional images of objects. Contents: General concepts of the AutoCAD graphic editor. Configure drawing parameters and create a new template. Working with multiple files. Geometric modeling of objects. The main types of models. Tools for creating basic complex geometry. Annotation of the drawing. Editing tools. Setting up dimensional styles. Drawing sizes. Working with blocks. External links. Dialog methods of graphical spatial design, dialog graphical input methods. Filters for selecting objects and forming groups. Information extraction tools. Methods of constructing three-dimensional models. Expanding the capabilities of technical drawing software. Editing bodies. Visualization methods and visual styles.	4			**v**		**v**	**v**			**v**	**v**	**v**
		BD	EC	3D design	Purpose: Formation of skills in modern graphic editors, creation of three-dimensional models. Content: Basic tools for creating objects. Modification and editing of objects or their individual elements. Fundamentals of three-dimensional computer graphics in professional activity. Combining created objects into functional groups. Construction of simple three-dimensional models of real objects.							**v**			**v**			
		BD	EC	Information protection in computer systems	Purpose: To develop skills for the implementation of information security methods in computer systems. Contents: Basic principles of information protection in computer systems. Organization of safe storage of information. Data and program repositories. Protection of programs from unauthorized copying and unauthorized use of computer resources. Basic operating system security models. Network management. Multilevel protection	5			**v**	**v**		**v**	**v**		**v**		

					of corporate networks. Protection of information in networks. Basic requirements for information security systems.												
		BD	EC	Cryptographic methods of information protection	Purpose: To acquire knowledge and skills of using modern methods of information protection. Contents: Basic concepts of cryptography: general principles of differentiation of access rights to information on the Internet, ensuring information security. Recognition of the facts of violation of safety rules. Planning and implementation of measures to eliminate the consequences of violations of safety regulations. Criteria for evaluating the results of the data audit. Data security system audit and development of audit methodology, evaluation of its effectiveness.				**v**	**v**		**v**	**v**		**v**		
12	Modern technologies and models in specialization	PD	EC	Basics of Smart technologies	Purpose: Formation of ideas about the concept of Smart, scientific and theoretical knowledge and practical skills of complex application of advanced achievements of scientific and technological progress in "smart" projects. Content: The basic foundations of Smart technologies and the IT industry. Modern information, telecommunication and Internet technologies. Microprocessor technology and automation of production and technological processes. Modern mobile communications and the Internet of Things. Intelligent systems and "smart habitat organization".	6					**v**					**v**	
		PD	EC	Data analysis based on the Statistica software package	Purpose: Formation of scientific and theoretical knowledge in the field of analysis of statistical data and processes, practical skills and abilities of automated solution of related computational tasks in the framework of improving the culture of thinking. Contents: Basic provisions of automated processing and analysis of statistical data. Descriptive statistics and operations on statistical data. Assessment of the presence of dependence between variables. Laws of distribution of random variables and their properties; Statistical tables of conjugacy and their analysis. Time sequences of statistical quantities and their characteristics. The method of autoregression and moving average (ARPSS). Mathematical models of statistical processes. Multiple regression. Purpose and characteristics of the Statistica software package. Organization of the working environment and user interface. Tools and functionality. Calculation of typical characteristics of statistical data and time sequences.				**v**	**v**		**v**	**v**		**v**		
		PD	EC	Fundamentals of continuum mechanics	Purpose: Formation of students' theoretical knowledge about the basic theorems and models of continuum mechanics, skills of their implementation. Contents: Assumptions and methods of continuum mechanics. Scalar and vector fields. Fundamentals of tensor computing. Theory of deformations. Strain tensor. Strain rate tensor. Helmholtz theorems.	5		**v**		**v**		**v**	**v**				

					Stokes' theorem. The Gauss-Ostrogradsky theorem. Dynamic equations. The stress tensor. Hooke and Navier-Stokes laws. Models of ideal and viscous liquid. Fundamentals of thermodynamics. Laws of thermodynamics. Isothermal and adiabatic processes. Two-parameter environments.												
		PD	EC	Mathematical models of fluid and gas mechanics	Purpose: Formation of students' knowledge about the basic models of fluid mechanics and the ability to apply to applied problems. Contents: General laws and equations of fluid and gas mechanics. The concept of vortex and vortex-free currents. Speed circulation. Newton's law of friction. Navier-Stokes law of friction. Euler and Navier-Stokes equations. A complete system of equations describing fluid motion. Initial and boundary conditions. Integrals of the equation of motion. The Bernoulli equation. Integral of the total energy equation. Equations of equilibrium of liquids and gases and their integration. Vortex movements of the liquid. Potential movements. Navier-Stokes equations. Layered currents. Flow in a flat channel. The Couette current. Poiseuille flow in a round tube. Creeping currents.			**v**		**v**		**v**	**v**				
13	Special courses of the department's choice	BD	EC	Probability theory and mathematical statistics	Purpose: Formation of knowledge on probability theory and mathematical statistics within the framework of finite-dimensional random variables, skills of their application in mathematical models Contents: Basic concepts of probability theory: axiomatic justification of probability theory and the resulting properties of probability. Properties of random variables and their distributions. Bernoulli's scheme and related limit theorems. Numerical characteristics of random variables. Markov chains. Characteristic functions. The laws of large numbers and the central limit theorem. Conditional probability distributions and conditional mathematical expectations. Basic concepts of mathematical statistics. Point estimates and methods for obtaining them. Classification of ratings.	4		**v**		**v**		**v**	**v**				
		BD	EC	Probabilistic modeling methods	Purpose: Formation of students' ideas about the theoretical and probabilistic foundations for constructing hypothesis testing procedures, skills for estimating model parameters. Contents: Probabilistic model of binomial distribution, inverse binomial choice. A probabilistic model of the Poisson distribution. Probabilistic model of exponential distribution. Probabilistic model of normal distribution. Probabilistic model of aging and wear (gamma distribution). Probabilistic growth models (logarithmically normal distribution, Birnbaum-Saunders distribution).			**v**		**v**		**v**					
		BD	EC	Optimal control methods	Purpose: Formation of skills of qualitative analysis of models, the ability to obtain the optimal solution in optimization problems and their research. Contents: Fundamentals and tasks of linear programming. Economic and mathematical models. Graphical methods for solving linear	4		**v**		**v**		**v**	**v**		**v**		

					programming problems. Properties of a linear function. The Simplex method. Approaches to solving the linear programming problem. Methods for solving the linear programming problem. Transport task. Methods of its solution. Game theory. The main theorem of matrix games.													
		BD	EC	Models and methods of decision-making	Purpose: Formation of students' skills to use modern methods of development, adoption and optimization of management decisions. Content: Statement of the linear programming problem and its structure. Geometric interpretation of the linear programming problem. Solving a linear programming problem using a graphical method. The method of adjacent directions. Transport problem and methods of its solution. Simplex method. Elements of convex analysis. Convex sets and a function. The golden ratio method. Gradient methods. Gradient projection method. Step separation method. The Jacobi method. Purpose and scope of network planning and management. The network model and its elements. Game theory. Antagonistic games. Basic concepts of game theory. Grouping of games. Matrix games.			v		v		v	v		v		
		BD	EC	Equations of mathematical physics	Purpose: To form knowledge about the main classes of partial differential equations, as well as skills for solving them. Contents: Partial differential equations. Physical problems leading to equations of mathematical physics. Statement of the Cauchy problem, the main problems of mathematical physics and their physical meaning. Grouping (classification) of partial differential equations, partial differential equations of the second order and bringing them into canonical form. Generalized statement of the Cauchy problem. The Cauchy problem for the wave equation. The fundamental solution of the equation of thermal conductivity. Volumetric, surface thermal potentials, their properties and application. The Laplace equation. Solution of the Dirichlet problem, Poisson formula. The theorems of Harnack and Liouville. Additional conditions for mathematical physics equations. Boundary value problems for the wave equation. Fourier method for solving boundary value problems for a hyperbolic equation. Boundary conditions of the thermal equation. Limiting conditions of an elliptic type equation.	4		v				v		v			
		BD	EC	Practical course of mathematical physics in the Maple system	Purpose: Formation of problem solving skills using the packages of applied mathematical programs Maple and Mathematica. Content: Maple Environment. Interface. Working with the help system. Objects. Expressions. Maple commands. Standard functions. Analytical transformations. Operations with formulas. Type conversions. Evaluation operations. Operations with polynomials. Solving equations and inequalities. Geometric packages: planimetry, stereometry. Solving the simplest tasks. Graphics in Maple. Two-dimensional graphics options. Commands of two-dimensional			v				v		v			

					graphics. Two-dimensional graphic structures. Animation. Three-dimensional graphics options. Structures of three-dimensional graphics. Three-dimensional graphics commands. Animation. Mathematical analysis. Limits, sums, series. Linear algebra. Working with the matrix and vector structure. Basic vector and matrix operations. Differential equations. Exact and approximate solutions of Integral transformations. Interpolation. Cauchy tasks. Programming of properties and rules for calculating functions and operators.												
14	Module for acquiring new professional competencies	BD	EC	Disciplines in the additional educational program (Minor program)	Purpose: Formation of theoretical knowledge and practical skills for solving problems in a set of disciplines to obtain additional competencies in a chosen field that is not a profile. Content: Additional educational program (Minor), which defines a set of disciplines and (or) modules and other types of educational work defined by the student in order to form additional competencies in the chosen field, which is not a profile; individualization of students' education, increasing students' motivation.	12	v	v	v								v
15	Module of final certification	PD	UC	Pre-graduate or industrial practice	Purpose: Formation of theoretical and practical skills in the development and implementation of mathematical and computer models. Contents: System concepts of the definition of the problem under study for the development of the model. Problem statement. Definition of the modeling object, initial and boundary conditions. Development of construction of applied mathematical and computer models. Creating an algorithm and writing programs. Preparation of technical documentation for the mathematical and computer model being developed. Checking the adequacy of models and testing the results.	10			v	v	v	v					v
				Writing and defending a thesis, graduation project, or preparing and passing a comprehensive exam	Purpose: Writing and defending a thesis. Content:To confirm professional potential, demonstrate abilities in organizing and conducting independent research in the field of ICT; reasoned development of sound recommendations; disclosure of the level of qualification, theoretical knowledge and practical skills; demonstration of internal unity of work and display of the progress and results of the development of the chosen topic; application of the rules of registration and defense of the thesis; clarification of readiness for independent work on the profile.	8	v										
	Total					240											

5. SUMMARY TABLE REFLECTING THE VOLUME OF LOANS DISBURSED IN THE CONTEXT OF OP MODULES

Course of study	Semester	Number of modules to be mastered	Number of studied disciplines			Number of credits KZ					Total in hours	Total loans KZ	Quantity	
			OC	UC	EC	Theoretical training	Physical Culture	Educational practice	Industrial, pre-graduate practice	Final certification			Exam	dif. offset
1	1	3	5	1	1	28	2				900	30	6	1
	2	4	3	3	1	27	2	1			900	30	5	3
2	3	3	2	2	4	28	2				900	30	6	2
	4	6	3	2	2	24	2		4		900	30	5	2
3	5	5		1	6	30					900	30	6	1
	6	4			4	24			6		900	30	3	1
4	7	4		1	4	21					630	21	4	-
	8	3			4	21					630	21	4	-
	9	1				-			10	8	540	18	-	1
total		15	8	10	26	203	8	1	20	8	7200	240	39	11

6. STRATEGIES AND METHODS OF TRAINING, MONITORING AND EVALUATION

Learning strategies	**Student–centered learning:** the student is a center of teaching/learning and an active participant in the learning and decision-making process. **Practice-oriented training:** focusing on the development of practical skills.

Teaching methods	Conducting lectures, seminars, practical and laboratory work with:
	• using innovative technologies:
	  • problem-based learning;
	  • case study;
	  • group work;
	  • discussions and dialogues, intellectual games, olympiads, quizzes;
	  • software development;
	  • presentations;
	• rational and creative use of information sources:
	  • multimedia training programs;
	  • electronic textbooks;
	  • virtual laboratory work;
	  • digital resources.
	
	Organization of independent work of students, individual consultations.

Monitoring and evaluation of the achievability of learning outcomes	**Current control** on each topic of the discipline, control of knowledge in classroom and extracurricular classes (according to syllabus). Assessment forms: • survey in the classroom; • testing on the topics of the academic discipline; • control works; • protection of independent work; • discussions; • trainings; • colloquiums; • essays, etc. **Boundary control** at least twice during one academic period within the framework of one academic discipline. **Intermediate certification** is carried out in accordance with the working curriculum, academic calendar. Forms of holding: • exam in the form of testing; • oral exam; • written exam; • combined exam; • defense of term papers; • protection of practice reports. **Final certification.**

7. EDUCATIONAL AND RESOURCE SUPPORT OF THE EP

Information Resource Center	The structure of the JRC has 6 subscriptions, 16 reading rooms, 2 electronic resource centers (ERC). The basis of the network infrastructure of the OIC consists of 180 computers with Internet access, 110 automated workstations, 6 interactive whiteboards, 2 video doubles, 1 video conferencing system, 3 scanners of A-4 format, 3. The software of the OIC – AIBS "IRBIS-64" for MSWindows (a basic set of 6 modules), an autonomous server for uninterrupted operation in the IRBIS system. The library fund is reflected in the electronic catalog available to users on the website http://lib.ukgu .kz is on-line 24 hours 7 days a week. Thematic databases of their own generation have been created: "Almamater", "Works of scientists of SKSU", "Electronic Archive".Online access from any device 24/7 via an external linkhttp://articles.ukgu.kz/ru/pps. Working with catalogs in electronic form. The EC consists of 9 databases: "Books", "Articles", "Periodicals", "Works of the teaching staff of SKSU", "Rare books", "Electronic Fund", "SKSU in print", "Readers" of "SKU". The JIC provides its users with 3 options for accessing its own electronic information resources: from the Electronic Catalog terminals in the catalog hall and divisions of the JIC; through the university's information network for faculties and departments; remotely on the library's website http://lib.ukgu.kz /. Access to international and republican resources is open: "SpringerLink", "Envoy", "Web of Science", "EVSSO", "Epigraph", to electronic versions of scientific journals in open access, "Zan", "RMEB", "Adebiet", Digital library "Akpigress", "Smart-kitar", "Kitar.kz", etc. For people with *special needs* and disabilities, the library's website has been adapted to the work of visually impaired users in the JRC
Material and technical base	**Specialized audiences:** Computer classes and lecture halls equipped with modern functional and presentation equipment. Modern hardware and licensed software are installed in computer classrooms. All laboratory rooms are equipped with a new generation of computers, which are in working condition, allow for scientific and laboratory work, and are used in full. The computers are connected to a local network and connected to the high-speed network of the university.Lecture halls are equipped with computers and multimedia projectors, which allows teaching at a high level. **Laboratory devices and installations** Standard kit - "Molecular Physics" (Processing of the results of multiple direct

	measurements, Maxwell's Pendulum) -Installation "Electricity and Magnetism" (Modeling, Determination of the specific charge of an Electron by the magnetron method, Hall Effect) Standard kit -"Optics" (Dispersion, Diffraction, Polarization, Interference) - Installation for the study of electrics.hole transition - - Installation for studying the external photo effect - Installation for determining the resonant potential of an inert gas atom (mercury) with an oscilloscope - Installation for determining the width of the locking layer of the P-n junction and the impurity concentration in the avalanche breakdown area - Instruments and equipment

APPROVAL SHEET

according to the educational program "6B06140-"Mathematical and computer modeling"

Director DAA _____ Naukenova A.S.

Director DASc _____ Nazarbek U.B.

Director of DE&C _____ Bazhirov T.S.

Annex 1

REVIEW
for the educational program
6B06140 - Mathematical and computer modeling
(code and name)

developed in the NJSC M. Auezov SKU, Shymkent

1. Brief description of the enterprise and the profile of its activities

NJSC " M. Auezov South Kazakhstan University is the leading multidisciplinary university in the Turkestan region. The structure of the university has a Higher School of Information Technology and Energy, on the basis of which the proposed EP is supposed to be implemented. The graduating department "Information systems and modeling" was determined responsible for the implementation of the EP.

2. Relevance and relevance of the EP

The training of students in the educational program 6B06140 - "Mathematical and computer modeling" seems to be very relevant in the framework of the implementation of the State program "Digital Kazakhstan". Its focus on meeting the current and future needs for highly qualified specialists in mathematical and computer modeling will undoubtedly contribute to the development of the economy through the widespread use of modern scientific and technological progress in the field of modeling various processes and the use of information technologies, informatization and automation of production and business management functions. processes.

3. Learning outcomes and competencies, their relationship with the demands of the labor market

The learning outcomes and competencies embedded in the EP, the theoretical knowledge, practical skills and professional skills provided are fully consistent with the modern qualification requirements for specialized specialists with a bachelor's qualification.

4. The presence of components that develop practical skills

The academic disciplines of the EP of basic and specialized training provide the formation of the necessary practical skills of a specialist who has fundamental knowledge in the field of mathematics, who owns computer methods for collecting, storing and processing information used in his professional activities, who is able to assess the progressiveness of the methods used to solve the tasks that are competitive in the domestic and international labor markets.

5. The content of the educational program (modules, disciplines)

The proposed educational program contains all the necessary elements for the effective organization of the educational process - it regulates the goals, expected results, content, conditions and technologies for the implementation of the educational process, the assessment of the quality of training a specialist with a bachelor's degree. Includes: curriculum, work programs of training courses, modules and disciplines, related materials: work practice programs, academic calendar, educational and methodological complexes of disciplines.

The content of the curriculum fully corresponds to the direction of training specialists, it is thought out and competently completed with content. The academic disciplines included in the plan cover the entire range of topical issues and problems in the profile of training, are fully capable of forming the necessary specialized knowledge, skills and abilities in the field of mathematical and computer modeling.

The distribution of disciplines by study periods is rational and logically verified. All types of educational activities are provided for the training of highly qualified specialists with the skills of research work - theoretical training, industrial practice, design and defense of theses. The planned volume and time resource for academic disciplines and types of training meet the qualification requirements for the level of graduates.

In accordance with the credit technology of education, the curriculum includes compulsory academic disciplines, disciplines of the university component and an elective component. The disciplines of the mandatory component ensure the formation of general and professional competencies. The disciplines of the university component and the elective component expand and deepen the training of students, contribute to the acquisition of additional competencies, knowledge and skills necessary to ensure the competitiveness of the graduate to the requirements of the labor market.

6. Quality of the modular guide

The composition of educational modules covers all relevant areas of training specialists in the field of mathematical and computer modeling. The content of the modular reference book of the educational program corresponds to the accepted competence model of the graduate.

7. Conclusion on the EP

Based on the foregoing, I consider it possible to assert that the goals and content of the presented educational program correspond to modern qualification requirements for the training of bachelors specializing in mathematical and computer modeling.

Director of «Innova Corporation Company» Turdaliev Zh.K.

Annex 2

Expert opinion
for the educational program
6B06140-"Mathematical and computer modeling"

1. Relevance of the EP

The development of information and telecommunication technologies is impossible without appropriate staffing. Recently, there has been a significant shortage of specialists who are able to create and successfully operate modern ICT in the field of mathematical and computer modeling. The dynamism of the development of the industry causes the rapid obsolescence of knowledge, therefore, constant updating and optimization of educational programs in the field of information and communication technologies is required.

Further development of the direction in the field of information and telecommunication technologies depends on the correct choice of the concept of training specialists of higher professional education.

2. Compliance of the EP with the formulated goals, consistent with the mission of the university, the requests of employers and students

The educational program 6B06140 - "Mathematical and Computer Modeling" formulates: the concept of the educational program, the goals and objectives of training specialists, the requirements for the organization of the educational process and for applicants, the learning outcomes of the EP, and also contains a description of the qualification characteristics of the graduate of the educational program, his key and professional competencies, information about the disciplines. The list of academic disciplines and their content meet the modern qualification requirements for specialists in the field of "Mathematical and computer modeling".

The selection of academic disciplines, the requirements laid down in relation to the formed knowledge, practical skills and professional competencies are fully consistent with the mission of the university "Formation of the country's intellectual elite based on the generation of new knowledge and the transformation of the university into an entrepreneurial university", meet the needs of employers and students.

3. Compliance with the National Qualification Framework of the Republic of Kazakhstan

The objectives and content of the EP correspond to the 6th level of the National Qualification Framework of the Republic of Kazakhstan.

4. Reflection in the EP of learning outcomes and competencies based on the Dublin descriptors laid down in professional standards / industry frameworks

The EP is harmonized with the Dublin descriptors, the 2nd cycle of the Qualifications Framework for the European Higher Education Area (A Framework for Qualifications of the European Higher Education Area), the 6th level of the European Qualifications Framework for Lifelong Learning (The European Qualifications Framework for Lifelong Learning).

5. Compliance with the classifier of areas of training with higher education

The structure and content of the EP correspond to the requirements of the classifier of areas of training of personnel with higher education of the educational program 6B06140-"Mathematical and computer modeling"

6. The structure and content of the EP, the application of the modular principle of their construction

The curriculum includes disciplines of the university component and disciplines of the elective component.

To avoid duplication of topics in the disciplines of the OP or due to the loss of relevance of the disciplines, the number of credits of disciplines has been reduced or excluded from the OP with replacement with newer ones.

In connection with the transformation of the university into a research university, disciplines have been added that contribute to the formation of students' skills in mathematical and computer processing of experimental data during research.

The requirements of the SSO EOM are taken into account when planning and organizing a thesis and a comprehensive exam.

Adjusted the results of training in the OP according to professional standards.

The roadmap for the development of inclusive education in OVPO organizations was used with the introduction of the clause conditions for the implementation of OP for persons with disabilities and OOP.

The disciplines of the university component ensure the formation of general and professional competencies.

The disciplines of the elective component expand and deepen the training of students, contribute to obtaining additional competencies, knowledge and skills necessary to ensure the competitiveness of the graduate to the requirements of the labor market.

The modular construction of the educational program allows you to obtain integrated knowledge in modules containing interrelated disciplines. The modular approach is designed to ensure the gradual development of the educational program.

The composition of educational modules covers all relevant areas of training of highly qualified specialists in the field of application of information systems that are competitive in the domestic and international labor markets.

7. The presence in the EP of components for preparing for professional activities that develop key competencies, intellectual and academic skills, reflecting the changing demands of society, including the implementation of the presidential program for mastering three languages: Kazakh, Russian and English

The content of the EP corresponds to the direction of training specialists, it is thought out and competently completed with content. The included academic disciplines cover the entire range of topical issues and problems in the training profile, are fully able to form the necessary specialized knowledge, skills and abilities in the field of mathematical and computer modeling, and require mastery of the Kazakh, Russian and English languages.

8. The logical sequence of disciplines and the reflection of the main requirements in the curricula and training programs

The distribution of disciplines by study periods is rational and logically verified. All types of educational activities are provided for the training of highly qualified specialists with the skills of research work - theoretical training, industrial practice, writing and defending a

thesis. The planned volume and time resource for academic disciplines and types of training meet the qualification requirements for the level of graduates.

The structural parts of the educational program are interconnected, successive, aimed at achieving the planned comprehensive result and are disclosed deeply and in full.

The methodological equipment of the educational program contributes to the successful solution of problems in key areas of training, education and development of students.

The EP is fully provided with educational and methodological documentation and related materials. The content of the disciplines of the educational program corresponds to the accepted competence model of the graduate.

9. Reflection in the EP of the system for accounting for the workload of students and teachers in credits, its compliance with the parameters of the credit system of education.

The content of the EP fully complies with the requirements of the credit technology of education, including in terms of taking into account the teaching load of teachers and students in loans. It is envisaged to study 240 credits.

10. The presence in the programs of industrial practice to consolidate the theoretical material, expressed in the teaching load in credits

The educational program provides for three types of practice: educational in the amount of 1 credit, production I in the amount of 4 credits, production II in the amount of 6 credits and undergraduate in the amount of 10 credits.

11. Information about the teaching staff involved in the implementation of the EP

The OP reflects information about the teaching staff involved in its implementation. The qualification requirements for teaching staff are observed.

12. Qualification obtained as a result of mastering the EP

Upon mastering the EP, the graduate will be awarded the qualification of a bachelor in the field of information and communication technologies according to the educational program 6B06140 - "Mathematical and computer modeling"

13. Recommendations

In accordance with the foregoing, it seems possible to assert that the objectives and content of the EP correspond to modern qualification requirements for the training of bachelors specializing in information and communication technologies.

It is recommended to accept the presented educational program for implementation.

Expert Musabekova L.M.
Doctor of Technical Sciences,
Professor of the Department of Computing and software

Annex 3

Professional Standards

APPLICATION NO. 1
TO THE ORDER OF THE ACTING CHAIRMAN OF THE BOARD
OF THE NATIONAL CHAMBER OF ENTREPRENEURS
REPUBLIC OF KAZAKHSTAN "ATAMEKEN"
NO. 222 DATED 12/05/2022

professional standard
"Database Administration"

1. General provisions

1. The professional standard "Database Administration" is intended for the formation of educational programs, including for training personnel at enterprises, for certification of employees and graduates of educational institutions, for solving a wide range of tasks in the field of personnel management.

On the basis of this professional standard, organizations can develop corporate professional standards for employees for internal use, specifying the level of professional education, the list of labor functions, knowledge, skills and abilities, taking into account the specifics of the organization of production, labor and management, and their responsibility.

2. The following terms and definitions apply in this professional standard:

1) qualification - the degree of readiness of an employee for the qualitative performance of specific labor functions;

2) skill level - a set of requirements for the level of training and competence of an employee, differentiated by the parameters of complexity, non-standard labor actions, responsibility and independence;

3) national qualifications framework - a structured description of qualification levels recognized in the labor market;

4) national system of qualifications - a set of mechanisms for legal and institutional regulation of demand and supply for the qualifications of specialists from the labor market;

5) sectoral qualifications framework - a structured description of the qualification levels recognized in the industry;

6) professional group - a set of professional subgroups that has a common integration basis (similar or close purpose, objects, technologies, including labor tools) and implies a similar set of labor functions and competencies for their performance;

7) professional subgroup - a set of professions, formed by a holistic set of labor functions and the competencies necessary for their performance;

8) professional standard - a standard that defines in a particular area of professional activity the requirements for the level of qualification and competence, content, quality and working conditions;

9) profession - the main occupation of a person's labor activity, requiring certain knowledge, skills and practical skills acquired as a result of special training and confirmed by relevant documents on education;

10) labor function - a set of interrelated actions aimed at solving one or more tasks of the labor process.

3. The following abbreviations are used in this professional standard:

1) SQF - sectoral qualification framework;

2) PS - professional standard;

3) KS - qualification directory of positions of managers, specialists and other employees;

4) Software - software;

5) DB - database;

6) IS - information security;

7) DBMS - database management system;

8) OS - operating system;

9) IS - information system.

2. Professional standard passport

PS name:	"Database Administration"
Purpose of PS development:	Systematic and structured description of labor functions, relevant requirements for knowledge, skills, abilities and personal competencies of employees.
Brief description of the PS:	Installing, configuring, monitoring the functioning of database management systems, providing information security, managing enterprise database backups, developing the area of enterprise activity in terms of ensuring fault tolerance of the database server (s).
Group names	Main group: Information and communication technologies. Professional group: Implementation and administration of database management systems. Professional subgroup: Database implementation and maintenance.

3. Occupation cards

List of professions	DBA	4th level of ORK
	DBA	Level 5 ORC
	DBA	6th level of ORC

PROFESSION CARD
"DATABASE ADMINISTRATION SPECIALIST"

Profession code:	2139 "IT professionals not included in other groups"
Profession name:	"Database Administrator"
ORK qualification level:	6. Higher education, practical experience

Qualification level for CS	-
Labor functions	1) Installing and configuring software. 2) Security functioningD B . 3) Monitoring And control reservecopying the database. 4) Ensuring database IS. 5) Analysis And setting DBMS performance. 6) Ensuring the smooth operation of the database. 7) Database development management.
Labor function 1	**Skills and abilities:**
Installing and configuring software	1. Evaluation and development of requirements for the hardware and software complex, based on the prospects for using the database. 2. Design hardware and softwarecomplex for installing the database. 3. Choice most effective DBMS Forsoftware installation and configuration. 4. Design structures DB With taking into accountprospects for using the database. 5. Implementation effective settingshardware-software complex. 6. Use of technical documentation for installing and configuring software.
	Knowledge: 1. Technical characteristics hardware-software complex. 2. Features of various DBMS. 3. DBMS requirements. 4. Requirements for system and application software. 5. Mechanisms for managing resources of the hardware-software complex. 6. IS architecture using databases. 7. Database design. 8. Methods and principles of information security.
Labor function 2 Ensuring the functioning of the database	**Skills and abilities:** 1. Analysis and taking measures to solve complex emergency situations and incidents that arise during the operation of the DBMS. 2. Analysis of information about the operation of the database obtained during the operation of the database. 3. Coordination of database administration work. 4. Development regulatory and technicaldocumentation on the functioning of the database. 5. Analysis of the need to upgrade the hardware and software complex based on the results of the operation of the database. 6. Forecast and risk assessment of database failures.
	Knowledge: 1. The composition of the operating hardware and software complex and the technical characteristics of its components. 2. Composition and functionality of database administration software. 3. Methods for monitoring the functioning of the database. 4. Information analysis methods. 5. Fundamentals of risk management.
Labor function 3 Monitoring And controldatabase backup	**Skills and abilities:** 1. Development regulatory and technicaldatabase backup documentation. 2. Organization and control of execution of work on database backup. 3. Control performance regulating database backup documents.

	Knowledge: 1. hardware and software complex,used in various database backup systems, and the technical characteristics of its components. 2. Modern system and application software for performing database backup and recovery procedures. 3. Methods for creating database backup procedures. 4. Features and differences of the hardware-software complex for storing backup copies of the database.
Labor function 4 Ensuring database IS	**Skills and abilities:** 1. Analysis of possible database security threats. 2. Development regulatory and technicaldocumentation to ensure database IS. 3. Use of means and methods of control of access to a DB. 4. Compliance with the enterprise information security policy.
	Knowledge: 1. Various database management systems. 2. Facilities And methods management accountingdatabase user records. 3. Various methods for ensuring database security when using application software. 4. Means and methods of database access control. 5. Methods and principles of information security.
Labor function 5 Analysis And DBMS performance tuning	**Skills and abilities:** 1. Analysis of statistical information to assess the performance of the database. 2. Using the range of available database management tools and methods to assess the load when executing database queries. 3. Analysis and evaluation of the effectiveness of the functioning of the database. Development of a long-term plan for the development of a hardware and software complex in order to increase the performance of the DBMS.
	Knowledge: 1. Tools for monitoring, collecting and analyzing statistical information about the operation of the database. 2. Various methods and tools for analyzing and evaluating database performance. The composition of the operating hardware and software complex and the technical characteristics of its components.
Labor function 6 Ensuring the smooth operation of the DBMS	**Skills and abilities:** onstruction and administration of the cluster architecture of database servers. 2. Inspection of the state of the DBMS and database servers in order to implement preventive measures for maximum IS availability. 3. Analysis and identification of the causes of failures in the operation of the DBMS with their subsequent elimination. 4. Development of procedures for emergency situations related to the operation of the DBMS, as well as when restoring the database.
	Knowledge: 1. The composition of the operated software and hardware-software complex. 2. Methods effective recoveryperformance of the DBMS and database. 3. Existing methods settingsdatabase mirroring and database replication methods. 4. Facilities And mechanisms updatesoperated software.
Labor function 7 Database development management	**Skills and abilities:** 1. Analysis of the hardware and software complex market. 2. Development of a strategy for the development of the use of DBMS in the organization. 3. Learning best practices in database administration. 4. Planning for software upgrades and/or data migration. 5. Carrying out work on installing updates to the DBMS version after preliminary testing of updates in a test environment.

	Knowledge: 1. World experience use systemsdatabase management. 2. Database development strategies and organization database management system. 3. Facilities And mechanisms updatesoperated software.	
Requirements To personal competencies	organization, initiative, attentiveness, responsibility, discipline, performance,analytical thinking, planning, decision making, critical analysis, result orientation, striving for professional development, work in team.	
Connection With others professions V within the RFC	2131	System Architect
	213	Team leader
Professional Standard Specifications		
Developed	JSC"National infocommunication Holding "Zerde" Approved by the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs Republic of Kazakhstan "Atameken" No. 171 dated July 17, 2017	
Version number and year of release	Version 1, 2015	
Date of indicative revision	2018	
Updated:	CIB ICRIAP RK	
The expertise is provided by:	Organization: ALE "Kazakhstan Information Security Association" Experts and contact details of experts: General Director Pokusov V.V. +7 771 716 18 16	
Version number and year of release:	Version 2, 2022	
Date of indicative revision:	2025	

APPENDIX NO. 20

TO THE ORDER OF THE ACTING CHAIRMAN OF THE

BOARD OF THE NATIONAL CHAMBER OF ENTREPRENEURS

REPUBLIC OF KAZAKHSTAN "ATAMEKEN"

NO. 222 DATED 12/05/2022

Professional Standard: Software Maintenance

Glossary

The following terms and definitions apply in this professional standard:

Information system (IS)- an organizationally ordered set of information and communication technologies, service personnel and technical documentation that implement certain technological actions through information interaction and are designed to solve specific functional problems.

Information technology (IT, IT)is a process that uses a set of means and methods for collecting, processing and transmitting data to obtain information of a new quality about the state of an object, process or phenomenon. Information technology (IT, from the English. Information Technology, IT) is a class of areas of activity related to technologies for managing and processing a huge flow of information using computer technology.

IS maintenance- ensuring the use of the IS put into commercial operation in accordance with its purpose, including measures to correct, modify and eliminate software defects, without upgrading and implementing additional functional requirements and subject to maintaining its integrity.

Information system architecture- a concept that defines the model, structure, functions performed and the relationship of the components of the information system.

Database- a set of data organized according to a conceptual structure that describes the characteristics of this data, as well as the relationships between their objects.

Graphical user interface(Graphical User Interface-GUI) - a specific program that provides the ability to use user interface elements in the form of graphical objects.

User Interface (UI)- elements of the system interface that are used by the user while working in the system (menus, buttons, dialog boxes) in the form of objects, which takes into account the color scheme, size, style and other graphic features.

Program development automation systems (CASE - tools)- a set of software engineering tools and methods for software design that helps to ensure high quality programs, the absence of errors and ease of maintenance of software products.

IR– Information and communication technologies;

BY- Software;

DB- Database

1. Professional standard passport

Name of the Professional Standard:	Software maintenance
Professional Standard Number:	

The names of the section, section, group, class, and subclass according to OKED:	J Information and communication 62 Computer programming, consulting and other related services 62.0 Computer programming, consulting and other related services 62.01 Computer programming activities 62.01.1. Software development.		
Brief description of the Professional Standard:	Setting up, configuring, monitoring, upgrading, eliminating software failures, assessing the adequacy and effectiveness of the internal control system and the risk management system in the field of information technology, conducting and maintainingparticipation in complex information security audits, management of planning and conducting audit procedures,development of programs, methods of checks on the audit of information technology.		
2. Occupation cards			
List of profession cards	Software Maintenance Specialist	5th - 6th levels of ORC	
	ICT auditor	6th - 7th levels of ORC	
PROFESSION CARD:SOFTWARE MAINTENANCE SPECIALIST			
Code:	2513-0-001		
Group code:	2513-0		
Profession:	Software Maintenance Specialist		
Other possible job titles:	-		
Qualification level for ORK:	6		
The main purpose of the activity:	Organize software upgrades based on bug fixes.		
Labor functions:	Mandatory job functions:	1. Software product monitoring and error detection	
		2. Participation in software upgrades	
	Additional labor functions:	-	
Labor function 1: Software product monitoring and error detection	**Task 1:** Organization of work to eliminate failures and errors	**Skills:**	
		1. Conduct an analysis to eliminate and restore the functionality of the software 2. Install virus protection. 3. Solve issues of software reliability.	
		Knowledge:	
		1. Antivirus software 2. Modern programming languages 3. Theory of queuing	
	Task 2: System error detection and failure handling	**Skills:**	
		1. Maintain software databases 2. Maintain file systems 3 . Advise on the operation of the software 4. Conduct an analysis to determine the benefits of new software with evidence of its superiority over old software 5. Compile a report on the analysis of the software	
		Knowledge:	
		1. Knowledge of modern software applications. 2. Database management systems 3. Operating systems and their structure.	
Labor function 2: Participation in software upgrades	**Task 1:** Improvement of individual modules of the program	**Skills:**	
		1. PSolve individual tasks in accordance with a new or additional technical task for a software product. 2. Follow proceduresenhancements to the functionality or performance of the software 3.Perform functional maintenance of software on customer machines.	
		Knowledge:	
		1. Software life cycle 2. Programming, types and data structures. 3.Software architecture and functionality	
	Task 2: Restoring, updating, deleting, modifying software files	**Skills:**	
		1. Fix software bugs in software files 2. Restore the work of memory, files, register errors 3. Perform systematic software maintenance (update, protect, upgrade) up todecommissioning. 4.Monitor the operation of the software, take notes and make suggestions for improving the place where conflicts are systematically detected	
		Knowledge:	
		1. The structure of operating systems 2. Fundamentals of project activities and phases of the software life cycle 3. International and national standards and requirements for software maintenance	
Requirements for personal competencies	Logical thinking. Flexibility of thinking. Organization. Creativity. Sociability. Learnability. Attentiveness. Discipline. Independence in decision making.		
Relationship with other professions within the OQF	6-7	ICT auditor	
Link to ETKS or KS or other job directories	KS	185. Programming Technician 140. Software Engineer	
Relationship with the system of education and qualifications	Level of education: higher (ISCED level 6)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT
3.Professional standard technical data			
Designed by:	Limited Liability Partnership “System Research Company “Factor” Project manager: Gabbasov M.B.		

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Appendix No. 36
to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs
Republic of Kazakhstan "Atameken"
dated December 24, 2019 No. 259

professional standard

"Testing Web and multimedia applications"

Glossary

The following terms and definitions apply in this professional standard:

Information system (IS)- an organizationally ordered set of information and communication technologies, service personnel and technical documentation that implement certain technological actions through information interaction and are designed to solve specific functional problems.

Information technology (IT, IT)is a process that uses a set of means and methods for collecting, processing and transmitting data to obtain information of a new quality about the state of an object, process or phenomenon. Information technology (IT, from the English. Information technology, IT) is a class of areas of activity related to technologies for managing and processing a huge flow of information using computer technology.

IS maintenance- ensuring the use of the IS put into commercial operation in accordance with its purpose, including measures to correct, modify and eliminate software defects, without upgrading and implementing additional functional requirements and subject to maintaining its integrity.

Information system architecture- a concept that defines the model, structure, functions performed and the relationship of the components of the information system.

Database (DB)- a set of data organized according to a conceptual structure that describes the characteristics of this data, as well as the relationships between their objects.

Software -a set of programs, program codes, as well as software products with technical documentation necessary for their operation.

Software interface -a system of unified links intended for the exchange of information between the components of a computing system, specifying a set of necessary procedures, their parameters and methods of handling.

Software -an independent program or part of software that is a product, which, regardless of its developers, can be used for the intended purposes in accordance with the system requirements established by the technical documentation.

Redesign– modification of the graphic and / or structural and functional components of an existing site or software product

Graphical user interface(GUI), graphical user interface (GUI) - a type of user interface in which the interface elements (menus, buttons, icons, lists, etc.) presented to the user on the display are executed in the form of graphic images.

web-page (eng. Web page) - a document or information resource of the World Wide Web, which is accessed using a web browser. A typical web page is an HTML text file

Web resourceis a page or set of pages hosted on the Internet, which may include both text and graphic information, as well as multimedia components (video, music, etc.).

front-endis the client side of the user interface to the software and hardware part of the service. This type of development includes everything that the user sees when opening a web page.

backend-this is a set of hardware and software tools that implement the logic of the web resource.

Search Engine Optimization(Englishsearch engine optimization, SEO) - a set of measures for internal and external optimization to raise the position of the site inissuance results search enginesaccording to certain user requests, in order to increasenetwork traffic(for web-resources) and potential customers (for commercial resources) and subsequent monetization (revenue generation) of this traffic. SEO can target a variety of search types, including image search, video search, news search, and industry-specific search engines.

Obfuscation(fromlat.obfuscare - obscure, obscure; AndEnglishobfuscate - make non-obvious, confusing, confusing) or code obfuscation - castingsource codeor the executable code of the program to a form that preserves its functionality, but makes it difficult to analyze, understand the operation algorithms and modify whendecompilation. One of the goals of obfuscation is to optimize the program in order to reduce the size of the running code and (if a non-compiled language is used) speed up the work.

ICT– Information and communication technologies;

BY- Software;

ISCED– International Standard Classification of Education

1. Professional Standard Passport	
PS name:	Web and multimedia application testing
PS number:	
The names of the section, section, group, class, and subclass according to OKED:	J Information and communication 62 Computer programming, consulting and other related services 62.0 Computer programming, consulting and other related services 62.01 Computer programming activities 62.01.1. Software Development 63.12 Web portals 63.12.0 Web portals
Brief description of the PS:	Creation, modification and maintenance of websites, corporate portals of organizations, multimedia and interactive applications, web resources on the Internet.

2. Occupation cards		
List of profession cards	web developer	5th-6th levels of ORC
	Web page developer	5th-6th levels of ORC
	Application developer	5th-6th levels of ORC
	Graphical user interface specialist	5th-6th levels of ORC
	GUI Architecture Specialist	5th-6th levels of ORC
	webmaster	5th-7th levels of ORC

PROFESSION CARD "WEB-DEVELOPER"		
Code:	2512-2-001	
Group code:	2512-2	
Profession:	web developer	
Other possible job titles:	web specialist web programmer Full stack developer	
Qualifying ORC level:	6	
The main purpose of the activity	Design, creation and modification of web resources, integration of web resources with other computer applications.	
Labor functions	Mandatory labor functions	1. Performing work on the creation (modification) of web-resources 2. Ensuring the safe and uninterrupted operation of the web resource 3. Development of technical documentation
	Additional labor functions	-
Labor function 1: Performing work on the creation (modification) of web-resources	**Task 1** Design and development of a front-end web resource	**Skills:** 1. Model domain structures 2. Use existing standard solutions and web resource templates. 3. Apply methods and tools for designing web resources, data structures, databases, programming interfaces 4. Apply methods and tools for assembling software modules and components, developing procedures for software deployment, data migration and transformation, creating programming interfaces 5. Generate reporting documentation based on the results of the work performed.

		Knowledge:
		1. Simulation Technique with Simulators 2. The device and functioning of modern web-resources. 3. Modern principles of building user interfaces 4. Modern methods for testing the ergonomics of user interfaces 5. The main requirements for the design of graphical interfaces, methods of transmitting information in text, graphics, sound, video and other multimedia formats, depending on the user category, taking into account the age and characteristics of disabilities 6. Network protocols and fundamentals of web technologies 7. Modern interpreted programming languages 8. Software life cycle 9. HTML and CSS 10. Features of the chosen programming environment and database management system 11. Software Development Methodologies 12. Methodology of object-oriented programming 13. Principles of constructing the architecture of web resources 14. Typical solutions, libraries of program modules, templates, object classes used in the development of web resources
	Task 2 Design and development of a back-end web resource	**Skills:**
		1. Design software in detail 2. Define relationships between objects. 3. Define processes produced by objects 4. Set process priority 5. Design database models and processes of its interaction with server applications. 6. Code in server-side programming languages (PHP, Ruby, Python, etc.)
		Knowledge:
		1. Software life cycle 2. Typical IS architectures. 3. Database Models 4. Basic knowledge of HTML 5. Web server administration 6. Methods for Designing Processes and Codes 7. Server programming languages (PHP, Ruby, Python, etc.) 8. Work with web servers 9. SQL - database query language 10. Network protocols and fundamentals of web technologies 11. Understanding how web servers work 12. Understanding the functioning of modern DBMS 13. Components of software and hardware architectures of web resources, existing applications and interfaces for interacting with them 14. Methods and tools for assembling and integrating software modules and components 15. Typical solutions, libraries of program modules, templates, object classes used in the development of web resources
Labor function 2: Ensuring the safe and uninterrupted operation of the web resource	**Task 1** Ensuring the safe and uninterrupted operation of the web resource	**Skills:**
		1. Install and configure information security software 2. Analyze event log messages 3. Develop regulatory documents 4. Identify incidents of violation of safe operation, and decide on changes in procedural procedures 5. Use regulatory and technical documentation in the field of software
		Knowledge:
		1. The essence and concept of information security, the main characteristics of its components 2. Sources of threats to information security and measures to prevent them 3. Modern software and hardware tools and ways to ensure the security of web resources 4. Architecture, device and functioning of computing systems 5. Principles of operation of communication equipment 6. Network protocols and fundamentals of web technologies 7. Fundamentals of modern database management systems 8. The device and functioning of modern web-resources 9. Modern standards of interaction between components of distributed applications 10. Fundamentals of information security of web resources 11. English at the level of reading technical documentation in the field of information and computer technology
	Task 3 Integration testing of a web resource with external services and accounting systems	**Skills:**
		1. Interpret customer business requirements to write test cases 2. Set requirements for test results 3. Work independently with information 4. Work in a team with other testers and developers 5. Develop regulatory documents
		Knowledge:
		1. Subject area of the project for drawing up test plans

		2. Change Management Basics 3. Architecture, device and functioning of computing systems 4. Principles of operation of communication equipment 5. Network protocols and fundamentals of web technologies 6. Fundamentals of modern database management systems 7. The device and functioning of modern web-resources 8. Database theory 9. Database storage and analysis systems 10. Basics of programming 11. Modern standards of interaction between components of distributed applications 12. Software tools and platforms for developing web resources 13. Fundamentals of information security of web resources
Labor function 3: Development of technical documentation	**Task 1** Analysis of requirements for a web resource and their formalization	**Skills:** 1. Analyze compliance requirements 2. Develop options for implementing requirements 3. Evaluate and justify recommended solutions 4. Apply methods and techniques for formalizing tasks 5. Use software products for graphical display of algorithms
		Knowledge: 1. Architecture, device and functioning of computing systems 2. Network protocols and fundamentals of web technologies 3. Fundamentals of modern database management systems 4. The device and functioning of modern information resources 5. Database theory 6. Database storage and analysis systems 7. Modern principles of building user interfaces 8. Modern methods for testing the ergonomics of user interfaces 9. Modern standards of interaction between components of distributed applications 10. Software tools and platforms for developing web resources 11. Methods for describing and modeling processes, process modeling tools 12. Fundamentals of the theory of system analysis and construction of interaction diagrams
	Task 2 Development of technical specifications for a web resource	**Skills:** 1. Choose the means of implementing the requirements for a web resource 2. Develop options for implementing a web resource 3. Evaluate and justify recommended solutions 4. Communicate with stakeholders 5. Develop and approve technical specifications for a web resource
		Knowledge: 1. Functional specification formalization languages 2. Methods and techniques for formalizing tasks 3. Methods and tools for designing a web resource. 4. Interface Design Methods and Tools 5. Database Design Methods and Tools 6. Architecture, device and functioning of computing systems 7. Network protocols and fundamentals of web technologies 8. The device and functioning of modern web-resources 9. Modern principles of building user interfaces 10. Modern standards of interaction between components of distributed applications 11. Software tools and platforms for developing web resources 12. Fundamentals of information security of web resources 13. Methods for describing and modeling processes, process modeling tools
Requirements for personal competencies	Analytical thinking, Critical analysis, Responsibility organization	
Relationship with other professions within the OQF	5	webmaster
	6	webmaster
Communication with ETKS or KS	KS	185. Technician - programmer 140. Software engineer (programmer)
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies Qualification: Bachelor in ICT
PROFESSION CARD "WEB PAGE DEVELOPER"		
Code:	2512-2-002	
Group code:	2512-2	
Profession:	Web page developer	
Other possible job titles:	web designer Front end developer	
Qualification level for ORK:	6	
The main purpose of the activity	Design, layout of web pages, content filling, administration and updating of a web resource	
Labor functions:	Mandatory job functions:	1. Working with requirements for a web resource
		2. Web page layout
		3. Technical and informational support of the web resource
	Additional labor functions:	-
Labor function 1:	**Task 2:**	**Skills:**

Working with requirements for a web resource	Determination of the customer's initial requirements for a web resource and the possibility of their implementation	1. Conduct negotiations. 2. Conduct presentations. 3. Prepare event protocols. 4. Translate requirements concepts into content 5. Translating requirements concepts into visual design **Knowledge:** 1. Examples of implementation in the subject area of the project. 2. Methods for identifying requirements. 3. Technologies of interpersonal and group communication in business interaction, the basics of conflictology. 4. Technologies for preparing and conducting presentations. 5. Principles of operation of communication equipment 6. Network protocols and fundamentals of web technologies 7. Fundamentals of modern database management systems. 8. The device and functioning of modern web-resources 9. Business Correspondence Rules 10. Legal requirements for web resources 11. Information structure 12. Style sheet languages 13. Knowledge of the principles and processes of providing client and personal services.
Labor function 2: Web page layout	**Task 1:** Web page optimization	**Skills:** 1. Analyze web pages and their components, analyze the stages of loading web pages and analyze the characteristics of browsers with which web pages are usually loaded 2. Minify, obfuscate and compress code (HTML, CSS and JS). 3. Perform image optimization (compression, format) 4. Eliminate redundant code (for optimization purposes) 5. Optimize the number of requests 6. Optimize layout for different browsers 7. Optimize the structure of web pages **Knowledge:** 1. Optimization Goals 2. web services,allowing you to get a comprehensive assessment of the client performance of the site being tested 3. Key Features of Common Browsers 4. Scripting programming languages 5. Markup languages 6. Style sheet languages 7. minimization methods,obfuscationand code compression 8. Image optimization methods 9. Methods for eliminating redundant code 10. Methods for reducing the number of requests 11. Setting up caching 12. Layout optimization methods 13. Features of displaying web pages 14. Web page structure 15. Features of loading external objects by browsers 16. Page loading stages 17. Distributed content storage 18. Compression methods supported by browsers 19. Setting up web servers
Labor function 3: Technical and informational support of the web resource	**Task 1:** Web resource administration	**Skills:** 1. Define or document backup and recovery plans 2. Identify, standardize and communicate levels of access and security 3. Solve computer software problems 4. Develop specifications or procedures for the development or maintenance of websites 5. Develop test procedures 6. Identify sources of problems with web pages and take action to fix them. **Knowledge:** 1. The essence and concept of information security, the main characteristics of its components 2. Sources of threats to information security and measures to prevent them 3. Modern software and hardware tools and ways to ensure the security of a web resource 4. Architecture, device and functioning of computing systems 5. Principles of operation of communication equipment 6. Network protocols and fundamentals of web technologies 7. Fundamentals of modern database management systems 8. The device and functioning of modern wb-resources 9. Modern standards of interaction between components of distributed applications 10. Fundamentals of information security of web resources 11. English at the level of reading technical documentation in the field of information and computer technology

Requirements for personal competencies	Organization, Attention, Discipline diligence, high learning ability, teamwork		
Relationship with other professions within the OQF	5	web developer	
	6	web developer	
Communication with ETKS or KS	KS	185. Programming Technician 140. Software engineer (programmer)	
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT

PROFESSION CARD
"APP DEVELOPER"

Code:	2512-2-004	
Group code:	2512-2	
Profession:	Application developer	
Other possible job titles:	Programmer Programmer-developer	
Qualification level for ORK:	6	
The main purpose of the activity	Develop, maintain applications and draw up related technical documentation	
Labor functions:	Mandatory job functions:	1. Integration of software modules and components, and verification of software product releases
		2. Requirements engineering and software design
	Additional labor functions:	-
Labor function 1: Integration of software modules and components, and verification of software product releases	**Task 1:** Development of procedures for integration of software modules	**Skills:** 1. Write program code for integration procedures for program modules. 2. Use the selected programming environment to develop procedures for integrating software modules. 3. Apply methods and tools for assembling modules and software components, developing procedures for deploying software, migrating and transforming data, and creating programming interfaces.
		Knowledge: 1. Methods and tools for assembling modules and software components. 2. Interfaces for interaction with the external environment. 3. Interaction interfaces of internal modules of the system. 4. Methods and tools for developing procedures for software deployment 5. Methods and means of data migration and transformation 6. Languages, utilities and programming environments, tools for batch execution of procedures
Labor function 2: Requirements engineering and software design	**Task 1:** Software requirement analysis	**Skills:** 1. Analyze compliance requirements 2. Develop implementation options. 3. Evaluate and justify recommended solutions. 4. Communicate with stakeholders
		Knowledge: 1. Possibilities of the existing software and hardware architecture 2. Possibilities of modern and perspective development tools for software products, hardware 3. Software Development Methodologies and Programming Technologies 4. Methodologies and technologies for designing and using databases
	Task 2: Development of technical specifications for software components and their interaction	**Skills:** 1. Choose means of implementing software requirements 2. Develop software implementation options 3. Evaluate and justify recommended solutions 4. Communicate with stakeholders
		Knowledge: 1. Functional specification formalization languages 2. Methods and techniques for formalizing tasks 3. Software design methods and tools 4. Methods and tools for designing software interfaces 5. Database Design Methods and Tools
	Task 3: Software design	**Skills:** 1. Leverage existing blueprints and software design patterns 2. Apply methods and tools for designing software, data structures, databases, programming interfaces 3. Communicate with stakeholders
		Knowledge: 1. Software architecture principles and types of software architecture 2. Standard solutions, libraries of program modules, templates, object classes used in software development 3. Software design methods and tools 4. Database Design Methods and Tools 5. Methods and tools for designing software interfaces
Requirements for personal	Structural thinking, perseverance and mindfulness	

competencies	Creative approach, Self-learning ability, Responsibility, Focus on the end result and customer requirements, Business communication skills		
Relationship with other professions within the OQF	6	Software Engineer	
Communication with ETKS or KS	KS	185. Programming Technician 140. Software engineer (programmer)	
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT

PROFESSION CARD
"SPECIALIST IN LAYOUT OF THE GRAPHIC INTERFACE"

Code:	2512-2-005	
Group code:	2512-2	
Profession:	Graphical user interface specialist	
Other possible job titles:	Graphic interface designer	
Qualification level for ORK:	6	
The main purpose of the activity	Design and develop a graphical user interface.	
Labor functions	Mandatory labor functions	1. Design, design and heuristic evaluation of the graphical user interface 2. Designing user interaction with the system
	Additional labor functions	-
Labor function 1: Design, design and heuristic evaluation of the graphical user interface	**Task 1:** Formal assessment of the graphical user interface and analysis of user interaction with the graphical interface	**Skills:** 1. Perform interface expertise 2. Calculate the expected speed of the interface 3. Evaluate use cases for the software interface 4. Use user experience analytics tools 5. Use systems for collecting and analyzing user interaction with the interface 6. Get user experience data from open sources 7. Develop reporting documentation
		Knowledge: 1. Interface Ergonomic Quality Assessment Systems 2. Standards governing the requirements for ergonomics of human-system interaction 3. Software Development Techniques 4. Methods for describing user requirements for a product 5. Interface peer review techniques 6. Ways to make interfaces available 7. Features of ensuring the accessibility of interfaces for users with disabilities 8. Methods of statistical data analysis
Labor function 2: Designing user interaction with the system	**Task 1:** Identification of user needs in the operation of software in terms of graphical user interfaces	**Skills:** 1. Obtain relevant professional information about user interaction with interfaces from open sources and analyze it 2. Conduct user interviews 3. Analyze received information about user interaction with graphical user interfaces 4. Create marketing personas (characters that reflect the target audience) and detailed user interaction paths with the product
		Knowledge: 1. Information collection methods 2. Activity Analysis Methods 3. Techniques for compiling marketing personas and customer journeys 4. Patterns of human behavior when using software products and hardware 5. Standards governing the requirements for ergonomics of human-system interaction 6. Marketing Basics
	Task 2: Designing styles of user interaction with the graphical user interface of a software product	**Skills:** 1. Develop user experience management mechanisms 2. Use mental models in interface design 3. Create uniform interface solutions
		Knowledge: 1. Factors Affecting User Experience 2. Learning Heuristics 3. Patterns of human behavior when using software products and

		hardware 4. General Practices for Designing Graphical User Interfaces 5. Standards governing the requirements for ergonomics of human-system interaction 6. Standards governing the interface of software products from different manufacturers 7. Fundamentals of psychology
	Task 3: UI prototype development and testing	**Skills:** 1. Work in interface prototyping tool environments 2. Define objects and methods for testing the graphical and/or user interface 3. Organize the interface prototype testing process 4. Documenting interface test results
		Knowledge: 1. User Experience Test Objects 2. Types and Types of User Experience Testing 3. Patterns of people's behavior when using software products 4. Common Interface Design Practices 5. Standards governing the requirements for ergonomics of human-system interaction 6. Standards governing the interface of software products from different manufacturers 7. Fundamentals of psychology
Requirements for personal competencies	Organization, Initiative, Attentiveness, Responsibility Discipline, diligence, result orientation High Learner, Business Communication Skills, Teamwork	
Relationship with other professions within the OQF	5	GUI Architecture Specialist
	6	GUI Architecture Specialist
Communication with ETKS or KS	KS	185. Programming Technician 140 Software Engineer
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies / Qualification: Bachelor in ICT

PROFESSION CARD
"GRAPHIC INTERFACE ARCHITECTURE DEVELOPER"

Code:	2512-2-006
Group code:	2512-2
Profession:	GUI Architecture Specialist
Other possible job titles:	Lead Graphic Interface Designer
Qualifying ORC level:	6
The main purpose of the activity	Design and study of the architecture of a graphical interface that provides high operational (ergonomic) characteristics of software products and systems

Labor functions	Mandatory labor functions	1. GUI Architecture Design 2. Expert analysis of the ergonomic characteristics of software products and/or hardware 3. Optimization of graphic interface solutions
	Additional labor functions	-
Labor function 1: GUI Architecture Design	**Task 1:** Conceptual design GUI	**Skills:** 1. Sketch interfaces 2. Prototype interfaces 3. Create conditional interface layouts 4. Read, create, modify and design interface block diagrams
		Knowledge: 1. Technical aesthetics within visual interface design 2. Feature classification systems and their applicability 3. Notations for recording structural diagrams, descriptions of the logic of the application 4. Design requirements for relevant platforms and operating systems 5. Appropriate platform and operating system design guides 6. Standards governing the requirements for ergonomics of human-system interaction 7. Interface Design Trends
	Task 2: Creation of structural guidelines for interface design and product standards for GUI	**Skills:** 1. Develop training material and interface design instructions 2. Use a text markup language 3. Use a stylesheet language 4. Work with layout and layout programs using markup languages
		Knowledge:

		1. Software Development Methods 2. Software development technologies 3. Areas of applicability of template interface solutions 4. Ergonomic standards 5. human-system interaction 6. Methods for working with glossaries of terms 7. Nomenclature of controls for target platforms and operating systems
Labor function 2: Expert analysis of the ergonomic characteristics of software products and/or hardware	**Task 1:** Ergonomic analysis characteristics of software products and hardware	**Skills:** 1. Evaluate the results of the initial analysis carried out and the limitations identified 2. Conduct user interviews 3. Analyze the received information about the user's activity 4. Create marketing personas (characters that reflect the target audience) and detailed user interaction paths with the product
		Knowledge: 1. Information collection methods 2. Activity Analysis Methods 3. Techniques for compiling marketing personas and customer journeys 4. Patterns of human behavior when using software products and hardware 5. Ergonomic standards 6. human-system interaction 7. Marketing Basics
	Task 2: Analysis of software products on subject of compliance with tasks users	**Skills:** 1. Work with various software products and devices (computers, smartphones, tablets, terminals). 2. Identify interface features that affect the performance of tasks by the user (simplify or complicate) 3. Detect non-compliance of the software product with standard solutions
		Knowledge: 1. Laws of perception of visual information 2. Patterns of human behavior when using software products and hardware 3. Common Interface Design Practices 4. Standards governing the requirements for ergonomics of human-system interaction 5. Standards governing the interface, manufacturers of various software products
Labor function 3: Optimization of graphic interface solutions	**Task 1:** Development of recommendations for optimization interface solutions for software products and hardware	**Skills:** 1. Develop interface solutions. 2. Follow the standards governing the characteristics of the interface of manufacturers of various software products. 3. Be aware of software and hardware limitations.
		Knowledge: 1. Principles of perception of information 2. Patterns of human behavior when using software products and hardware 3. Ergonomic standards 4. human-system interaction 5. Standards governing the interface, manufacturers 6. software products, operating systems, platforms 7. Fundamentals of technical aesthetics
	Task 2: Identifying Options interface solutions, the best appropriate to the tasks users	**Skills:** 1. Work with various software products and devices (computers, smartphones, tablets, terminals) 2. Identify interface features that critically affect the performance of tasks by the user (significantly simplify or complicate) 3. Identify inconsistencies between the interface and the standard solutions of the target platform of the system under study
		Knowledge: 1. Principles of perception of visual information 2. Patterns of human behavior when using software products and hardware 3. Standards governing the requirements for ergonomics of human-system interaction 4. Standards governing the interface, manufacturers of software products, operating systems, platforms
Requirements for personal competencies	Analytical thinking, Critical analysis, Responsibility Organization, Teamwork, Discipline	
Relationship with other professions within the OQF	5	Graphical user interface specialist
	6	Graphical user interface specialist
Communication with ETKS or KS	KS	185. Programming Technician 140 Software Engineer
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies Qualification: Bachelor in ICT
PROFESSION CARD "WEB-MASTER"		
Code:	2512-2-008	
Group code:	2512-2	
Profession:	webmaster	
Other possible job titles:	web programmer	

	2512-1-002 Software Engineer	
Qualifying ORC level:	6	
The main purpose of the activity	Perform work on the creation (modification) and maintenance of web resources	
Labor functions	Mandatory labor functions	1. Creation and support of a web resource
		2. Testing a web resource
		3. Web resource design
	Additional labor functions	-
Labor feature 1: Creation and support of a web resource	**Task 1:** Leading the software development process	**Skills:**
		1. Apply methods and means of planning and control (monitoring) of the execution of plans. 2. Apply the basic principles and methods of personnel management 3. Apply regulatory and technical documents (standards and regulations), the best world practices for managing the software product development process 4. Plan the software development process 5. Evaluate the quality of the software product development plan (resources, deadlines, risks). 6. Monitor the execution of software product development plans 7. Adjust the software development plan
		Knowledge:
		1. Methods and means of planning and control (monitoring) of the execution of plans 2. Methods for assessing the quality of a software product development plan (resources, deadlines, risks) 3. Basic principles and methods of personnel management 4. Regulatory and technical documents (standards and regulations), the best world practices for managing the software product development process
Labor function 2: Testing a web resource	**Task 1:** Organization of work on integration testing of a web resource with external services and accounting systems	**Skills:**
		1. Test a web resource using test plans 2. Work with test data preparation tools 3. Interpret customer business requirements to write test cases 4. Set requirements for test results 5. Work independently with information 6. Work in a team with other testers and developers
		Knowledge:
		1. Subject area of the project for drawing up test plans 2. Change Management Basics 3. Architecture, device and functioning of computing systems 4. Principles of operation of communication equipment 5. Network protocols and fundamentals of web technologies 6. Fundamentals of modern database management systems 7. The device and functioning of modern web-resources 8. Database theory 9. Database storage and analysis systems 10. Basics of programming 11. Modern standards of interaction between components of distributed applications 12. Software tools and platforms for developing web resources 13. Fundamentals of information security of web resources
	Task 2: Web Resource Health Check Guide	**Skills:**
		1. Prepare test datasets 2. Apply methods and means of checking the health of a web resource 3. Interpret data from message logs, protocols 4. Leverage existing technical and/or software architecture 5. Apply a collaborative software development environment and version control system 6. Apply management decision-making methods
		Knowledge:
		1. Regulatory documents that define the requirements for checking the health of the program code 2. Basic principles of debugging code 3. The main types of diagnostic data and ways to present them 4. Basic methods for measuring and evaluating software performance 5. Methods for preparing test datasets 6. Methods and means of checking the health of the software
Labor function 3: Web resource design	**Task 1:** Designing sections of a web resource	**Skills:**
		1. Apply software tools to design the interface of a web resource 2. Carry out the interface design process taking into account the existing rules for the subject area of the project. 3. Apply tools to evaluate the effectiveness and convenience of the created interface, apply the data obtained to optimize the interface
		Knowledge:
		1. Best Practices for Project Domain 2. The device and functioning of modern web-resources

		3. Modern principles of building user interfaces 4. Modern methods for testing the ergonomics of user interfaces 5. Basic requirements for the design of graphical interfaces, methods of transmitting information in text, graphics, sound, video and other multimedia formats, depending on the user category 6. Basics of pedagogical design (for developers of educational web-resources) 7. Modern domestic and foreign experience in professional activities	
Requirements for personal competencies	Analytical thinking, Critical analysis, Responsibility organization		
Relationship with other professions within the OQF	5	web developer	
	6	web developer	
Communication with ETKS or KS	KS	185. Technician - programmer 140. Software Engineer	
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT

3.Professional standard technical data	
Designed by:	Limited Liability Partnership "System Research Company "Factor" Project manager: Gabbasov M.B. Contact details of the head: Mars0@mail.ru +7 701 908 25 11 Project executors and contact details of executors: Abdeshov H.U. habdeshov@rambler.ru +7 777 2505831 Uvaleev Zh.E. zh_uali@mail.ru 87015228028 Baydeldinov M.U. Make3508@gmail.com +77013918037
The expertise is provided by:	Organisation: 10Tech LLP Experts and contact details of experts: Deputy General Director Boldyrev V.A. **87017173689**
Version number and year of release:	Version 1, 2019
Date of indicative revision:	30.12.2022

APPLICATION NO. 4
TO THE ORDER OF THE ACTING CHAIRMAN OF THE BOARD OF THE NATIONAL CHAMBER OF ENTREPRENEURS REPUBLIC OF KAZAKHSTAN "ATAMEKEN"
NO. 222 DATED 12/05/2022

Professional standard: "Ensuring the security of information infrastructure and IT"

Glossary

The following terms and definitions apply in this professional standard:

Information system (IS)- an organizationally ordered set of information and communication technologies, service personnel and technical documentation that implement certain technological actions through information interaction and are designed to solve specific functional problems.

Information technology (IT, IT)is a process that uses a set of means and methods for collecting, processing and transmitting data to obtain information of a new quality about the state of an object, process or phenomenon. Information technology (IT, from the English. Information technology, IT) is a class of areas of activity related to technologies for managing and processing a huge flow of information using computer technology.

IT infrastructureis a complex structure that combines all information technologies and resources used by a particular organization or company. The information technology infrastructure includes all computers, installed software, communication systems, information centers, networks and databases.

IS maintenance- ensuring the use of the IS put into commercial operation in accordance with its purpose, including measures to correct, modify and eliminate software defects, without upgrading and implementing additional functional requirements and subject to maintaining its integrity.

Information system architecture- a concept that defines the model, structure, functions performed and the relationship of the components of the information system.

Database (DB)- a set of data organized according to a conceptual structure that describes the characteristics of this data, as well as the relationships between their objects.

Software -a set of programs, program codes, as well as software products with technical documentation necessary for their operation.

Software interface -a system of unified links intended for the exchange of information between the components of a computing system, specifying a set of necessary procedures, their parameters and methods of handling.

Software -an independent program or part of software that is a product, which, regardless of its developers, can be used for the intended purposes in accordance with the system requirements established by the technical documentation.

ICT– Information and communication technologies;

BY- Software;

ISCED– International Standard Classification of Education

1. Professional Standard Passport	
Name of the Professional Standard:	Ensuring the security of information infrastructure and IT
Professional Standard Number:	

The names of the section, section, group, class, and subclass according to OKED:	J Information and communication 62 Computer programming, consulting and other related services 62.0 Computer programming, consulting and other related services 62.01 Computer programming activities 62.02 Computer consulting services 62.02.0 Computer consulting services	
Brief description of the PS:	Ensuring the security of information in computer systems and networks in the face of threats to their information security	
2. Occupation cards		
List of profession cards	Security Specialist (ICT)	5th-7th levels of ORC
	Information protection specialist	5th-7th levels of ORC
	Digital Forensic Specialist	6th-7th levels of ORC
	Data Encryptor	5th-7th levels of ORC
PROFESSION CARD: SECURITY TECHNICIAN (ICT)		
Code:	2524-0-005	
Group code:	2524-0	
Profession:	Security Specialist (ICT)	
Other possible names professions	Technician for the protection of infocommunication systems Information security engineer of infocommunication systems Information security expert	
Qualifying level according to the ORC	6	
primary goal activities	Countering the harmful effects of software and hardware impact on subsystems, devices, elements and channels of infocommunication systems	
Labor functions:	Mandatory labor functions	1. Administration of information security tools in computer systems and networks
	Additional labor functions	-
Labor function 1: Administration of information security tools in computer systems and networks	**Task 1:** Administration of information protection subsystems in operating systems	**Skills:** 1. Formulate operating system security policies 2. Configure operating system security policies 3. Assess threats to information security of operating systems 4. Counter threats to information security using the built-in information protection tools of operating systems 5. Select operating modes of software and hardware information protection tools in operating systems 6. Configure anti-virus information protection tools in operating systems 7. Install software and anti-virus protection updates 8. Monitor the functioning of software and hardware information protection tools in operating systems 9. Analyze the effectiveness of software and hardware information protection in operating systems 10. Evaluate the optimal choice of software and hardware for information protection and their modes of operation in operating systems
		Knowledge: 1. Architecture and principles of building operating systems 2. Operating system programming interfaces 3. Types of access and information flow control policies in relation to operating systems 4. Architecture of information protection subsystems in operating systems 5. Principles of operation of information security tools in operating systems, including those using cryptographic algorithms 6. The composition of typical configurations of software and hardware information protection 7. Requirements for the composition and characteristics of information security subsystems in relation to operating systems 8. The order of implementation of methods and means of anti-virus protection in operating systems 9. Software and hardware and methods of information protection in operating systems 10. Principles of operation and rules for the operation of software and hardware information security tools

		11. Normative legal acts in the field of information protection 12. Organizational measures to protect information
	Task 2: Administration of software and hardware information protection in computer networks	**Skills:**
		1. Assess information security threats in computer networks 2. Set up packet filtering rules in computer networks 3. Justify the choice of used software and hardware for information protection in computer networks 4. Configure and control the correctness of the settings of software and hardware for information protection in computer networks 5. Select operating modes of software and hardware information protection in computer networks 6. Monitor the functioning of software and hardware information protection in computer networks 7. Analyze the effectiveness of software and hardware information protection in computer networks 8. Evaluate the optimal choice of software and hardware for information protection and their modes of operation in computer networks
		Knowledge:
		1. Principles of building computer networks 2. Operating system network protocol stack 3. Network equipment protocol stack 4. The order of implementation of methods and means of firewalling 5. Principles of functioning of network protocols, including cryptographic algorithms 6. Types of access and information flow control policies in computer networks 7. Sources of threats to information security in computer networks and measures to prevent them 8. The composition of typical configurations of software and hardware information protection and their modes of operation in computer networks 9. Methods for measuring, monitoring and technical calculations of the characteristics of software and hardware information security 10. Principles of operation and rules for the operation of operated software and hardware information security tools 11. Software and hardware and methods of information protection in computer networks 12. Normative legal acts in the field of information protection 13. Organizational measures to protect information
	Task 3: Administration of information security tools for application and system software	**Skills:**
		1. Analyze software information security threats 2. Formulate rules for the safe operation of software 3. Justify the rules for the safe operation of software 4. Analyze the functioning of the software in order to determine the possible malicious impact 5. To check the compliance of the actual characteristics of the software and hardware information protection tools with those stated in their technical documentation 6. Take measures to counter threats to information security arising from the operation of software 7. Determine how the software operates to ensure information security 8. Analyze the effectiveness of the formulated requirements for the built-in information security tools of the software
		Knowledge:
		1. Architecture of information protection subsystems in operating systems 2. Principles of building database management systems 3. Basic tools and methods for analyzing software implementations 4. Principles of building antivirus software 5. Types of access and information flow control policies in relation to application software 6. Sources of software information security threats and measures to prevent them 7. Vulnerabilities of the used software and methods of their exploitation 8. Types and forms of functioning of malicious software 9. Typical signs of malware 10. Tools and methods for detecting previously unknown malware 11. Principles of operation of software tools for cryptographic information protection 12. The procedure for ensuring the security of information during the operation of the software 13. Normative legal acts in the field of information protection 14. Organizational measures to protect information
Requirements for personal competencies	Analytical thinking, Critical analysis, Responsibility Organization, Systems thinking, Ability to solve non-standard problems, Attention to detail	
Relationship with other professions within the OQF	5	Information protection specialist
	6	Information protection specialist
	7	Information protection specialist

Link to ETKS or KS or other job directories	KS	185. Programming Technician 140 Software Engineer	
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT
PROFESSION CARD: INFORMATION PROTECTION SPECIALIST			
Code:	2524-0-006		
Group code:	2524-0		
Profession:	Information protection specialist		
Other possible names professions	Information Security Technician Information security engineer		
Qualifying level according to the ORC	6		
primary goal activities	Administration of IP information protection systems		
Labor functions:	Mandatory labor functions	1. Ensuring the protection of information in IS during their operation	
		2. Implementation of information security systems in IS	
	Additional labor functions	-	
Labor function 1: Ensuring the protection of information in IS during their operation	**Task 1:** Diagnostics of IP information protection systems	**Skills:**	
		1. Classify and evaluate information security threats 2. Analyze software, architectural, technical and circuit solutions of automated system components in order to identify potential information security vulnerabilities in IS 3. Monitor the effectiveness of the measures taken to implement the information security policies of automated systems 4. Monitor security events and actions of users of automated systems 5. Apply technical means to control the effectiveness of information protection measures 6. Document the procedures and results of monitoring the functioning of the information security system of the automated system	
		Knowledge:	
		1. The content and procedure for the activities of personnel for the operation of protected IS and IS security subsystems 2. The main threats to information security and the model of the intruder in IS 3. Basic cryptographic methods, algorithms, protocols used to protect information in IS 4. Software and hardware to ensure the protection of IP information 5. Methods for protecting information from "leakage" through technical channels 6. Normative legal acts in the field of information protection 7. Organizational measures to protect information	
	Task 2: Administration of IP information protection systems	**Skills:**	
		1. Create, delete and modify IS user accounts 2. Plan the security policy of IS software components 3. Install and configure operating systems, database management systems, computer networks and software systems, taking into account the requirements for ensuring information security 4. Use cryptographic methods and means of protecting information in IS 5. Register events related to the protection of information in IS 6. Analyze events related to the protection of information in IS	
		Knowledge:	
		1. Principles of information security policy formation in IS 2. Hardware and software information protection IS 3. Basic cryptographic methods, algorithms, protocols used to protect information in IS 4. Methods for monitoring the effectiveness of information protection from "leakage" through technical channels 5. Criteria for evaluating the effectiveness and reliability of IS software protection tools 6. Technical means of monitoring the effectiveness of information protection measures 7. Principles of organization and structure of IP software protection systems 8. The content and procedure for the activities of personnel for the	

		operation of secure automated systems and IS security systems 9. Basic measures to protect information in IP
	Task 3: Information security management in IS	**Skills:**
		1. Assess information risks in IS 2. Classify and evaluate information security threats 3. Determine the information resources of automated systems to be protected 4. Apply regulatory documents on countering technical intelligence 5. Develop proposals for improving the IP information protection management system 6. Configure the parameters of the IP information protection system 7. Apply technical means to control the effectiveness of information protection measures
		Knowledge:
		1. Basic Information Security Management Methods 2. The main threats to information security and the model of the intruder in IS 3. Methods for protecting information from "leakage" through technical channels 4. Normative legal acts in the field of information protection 5. National, interstate and international standards in the field of information security
Labor function 2: Implementation of information security systems in IS	**Task 1:** Development of organizational and administrative documents for the protection of information in IP	**Skills:**
		1. Classify and evaluate information security threats 2. Apply regulatory documents on countering technical intelligence 3. Determine the settings for the software of the IP information protection system 4. Monitor the effectiveness of the measures taken to protect information in IP
		Knowledge:
		1. The content and procedure for the activities of personnel for the operation of protected IS and information security systems 2. The main threats to information security and the model of the intruder in IS 3. Basic cryptographic methods, algorithms, protocols used to protect information in IS 4. Principles of building means of protecting information from "leakage" through technical channels 5. Normative legal acts in the field of information protection
	Task 2: Implementation of organizational measures to protect information in automated systems	**Skills:**
		1. Implement rules for restricting personnel access to access objects 2. Analyze software and software and hardware solutions when designing an information security system in order to identify potential information security vulnerabilities in automated systems 3. Train IS personnel on a set of measures (rules, procedures, practices, guidelines, methods, tools) to ensure information security 4. Plan and organize the work of the IS personnel, taking into account the requirements for information protection 5. Configure certified information system and information system information protection systems
		Knowledge:
		1. Normative legal acts and national standards for licensing in the field of ensuring the protection of state secrets and certification of information security tools 2. Methods, methods, means, sequence and content of the stages of development of IS and protection systems for automated systems 3. Normative legal acts in the field of information protection 4. Organizational measures to protect information 5. Methods for certification testing of technical means of protecting information from "leakage" through technical channels for compliance with information security requirements 6. Methods, ways and means of ensuring fault tolerance of automated information systems
Requirements for personal competencies	Analytical thinking, Critical analysis, Responsibility Organization, Systems thinking, Ability to solve non-standard problems, Attention to detail	
Relationship with other professions within the OQF	5	Security Specialist (ICT)
	6	Security Specialist (ICT)
	7	Security Specialist (ICT)
Link to ETKS or KS or other job directories	KS	185. Programming Technician 140 Software Engineer

Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT

PROFESSION CARD: DIGITAL FORENSIC SPECIALIST

Code:		2524-0-008
Group code:		2524-0
Profession:		Digital Forensic Specialist
Other possible names professions		Digital Forensicist Computer forensics specialist
Qualifying level according to the ORC		6
primary goal activities		Analysis and investigation of events in which computer information appears as an object of encroachment, a computer as a tool for committing a crime, as well as any digital evidence
Labor functions:	Mandatory job functions:	1. Investigation of computer crimes
		2. Conducting digital forensics
	Additional labor functions:	-
Labor function 1: Investigation of computer crimes	**Task 1:** Primary response to computer crimes	**Skills:** 1. Identify sources and causes of incidents 2. Assess the consequences of identified incidents 3. Identify penetrations into the corporate network 4. Eliminate all established methods of intruder access to the organization's network 5. Analyze the structure of the mechanism of occurrence and the circumstances of the event 6. Determine the cause and conditions of the software change 7. Highlight the properties and features of information that allow you to establish its belonging to a particular source 8. Identify inconsistencies between available information and its location in the system
		Knowledge: 1. Main types of computer crimes 2. Ways for intruders to access the organization's network 3. The main threats to information security and the model of the intruder in the IS of the organization 4. Principles of construction and functioning of systems and networks of information transmission 5. National, interstate and international standards in the field of information security 6. Technical channels of "leakage" of information 7. Normative legal acts in the field of information protection 8. Reference model of interaction of open systems, basic protocols, sequence and content of the stages of construction and operation of modern local and global computer networks 9. The main methods of organizing and conducting maintenance of technical means of informatization 10. Organizational measures to protect information 11. Regulations for recording detected incidents 12. Information storage formats in the analyzed computer system

		13. Main file formats used in computer systems 14. The procedure for fixing and documenting traces of computer crimes, offenses and incidents Norms of criminal and administrative law in the field of computer information
	Task 2: Planning measures to prevent break-ins and unauthorized access	**Skills:**
		1. Develop measures to prevent and timely detect hacks 2. Search for evidence on computers 3. Identify methods and means of counter-forensics: full-disk encryption, remote storage of information, etc. 4. Collect the evidence base and its execution/storage 15. Simulate a real attack on the organization and train the skills to take measures to minimize damage from it
		Knowledge:
		1. Principles of construction and functioning of systems and networks of information transmission 2. Reference model of interaction of open systems, basic protocols, sequence and content of the stages of construction and operation of modern local and global computer networks 3. National, interstate and international standards in the field of information security 4. The main threats to information security and the model of the intruder in the IS of the organization 5. Methods and means of counter-forensic science 6. Principles of building means of protecting information from "leakage" through technical channels 7. Normative legal acts in the field of information protection 8. Basic cryptographic methods, algorithms, protocols used to protect information in IS 9. Basic principles for the seizure of computer equipment 10. Methods for hiding evidence from detection. 16. Documentation of investigation information
Labor function 2: Forensic examination of digital devices and equipment	**Task 1:** Forensic examination of computers	**Skills:**
		1. Investigate information security incidents 2. Record the time of the incident 3. Perform basic computer diagnostics 4. Work with hardware record blockers and media duplicators 5. Work with distribution kits for forensic analysis. 6. Capture an image (an identical copy) of a hard disk (NMHD) and other storage media, including capturing an image from a partition or a separate sector of a hard disk 7. Process generated disk images 8. Collect data from hard drives 9. Analyze files found on hard drives. 10. Extract data from files. 11. Perform memory dump analysis. 12. Search for artifacts on the hard drive and peripherals 13. Work with system logs and logs of operating systems and application programs 14. Recover deleted data 15. Collect the evidence base and its execution/storage
		Knowledge:
		1. Basic knowledge of file systems 2. Basic knowledge of operating systems 3. Basic principles of information security and methods of protection means 4. Computer Forensics Toolkit 5. Hard drives and other storage devices 6. Architecture and user interfaces of operating systems 7. Architecture, device and functioning of computing systems 8. Tools for working with the file system, including data recovery 9. Basic cryptographic methods, algorithms, protocols used to ensure information security
	Task 2: Forensic examination of network devices	**Skills:**
		1. Analyze the network stack and browsers. 2. Analyze email messages and determine the ownership of an email address. 3. Work with a toolkit to create a network traffic dump

		4. Capture and investigate network traffic 5. Analyze web server logs 6. Set the ownership and location of an IP address 7. Establish ownership of a domain name
		Knowledge:
		1. Principles of construction and functioning of systems and networks of information transmission 2. Reference model of interaction of open systems, basic protocols, sequence and content of the stages of construction and operation of modern local and global computer networks 3. Typical methods and protocols for identification, authentication and authorization in computer networks 4. Basic principles of conducting network forensics. 5. Regulations for the actions of employees in order to obtain the most detailed information for analysis 6. Typical data sources for conducting network forensics and their research 7. Features of the toolkit for creating a network traffic dump
	Task 3: Forensic examination of mobile devices	**Skills:**
		1. Perform mobile device identification 2. Perform cloning of all data from a digital device, peripheral equipment and storage media 3. Retrieve information from mobile phones 4. Retrieve information from the SIM card 5. Retrieve information from built-in and external memory cards 6. Control postal items, telegraphic and other communications 7. Work with software and hardware tools to access mobile phone data
		Knowledge:
		1. Principles and devices of mobile communication 2. Software and hardware tools for accessing mobile phone data 3. Basic cryptographic methods, algorithms, protocols used to ensure information security 4. Basic knowledge of mobile operating systems 5. Basic knowledge of mobile device file systems 6. Memory card device
Requirements for personal competencies	Analytical thinking. Critical analysis. Stress resistance. Responsibility. Organization. Learnability. Be able to work in a team	
Relationship with other professions within the OQF	-	
Link to ETKS or KS or other job directories	KS	140 Software Engineer 284. Design engineer
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies Qualification: Bachelor in ICT

PROFESSION CARD: DATA CRYPTOMER		
Code:	2524-0-009	
Group code:	2524-0	
Profession:	Data Encryptor	
Other possible names professions	encoder	
Qualifying level according to the ORC	6	
primary goal activities	Development and operation of data encryption systems	
Labor functions:	Mandatory job functions:	1. Operation of data encryption systems.
		2. Assessing the security level of data encryption systems
	Additional labor functions:	-
Labor function 1: Operation of data encryption systems	**Task 1:** Managing the operation of data encryption systems	**Skills:**
		1. Organize the smooth functioning of data encryption systems. 2. Install and configure the parameters of network protocols implemented in data encryption systems. 3. Develop proposals for improving and increasing the efficiency of technical measures taken and organizational measures taken to protect

		data encryption systems. 4. Organize work to meet the requirements of the information protection regime of limited access to data encryption systems 5. Develop methodological materials and organizational and administrative documents on data encryption systems
		Knowledge:
		1. Architecture, device and functioning of computing systems. 2. Network protocols and their settings. 3. Features of the use of software, firmware and hardware in data encryption systems. 4. Methods for comprehensive protection of data encryption systems. 5. Efficiency indicators of the applied software, software and hardware and technical means in data encryption systems 6. Regulatory legal acts in the field of protection of restricted access information 7. National, interstate and international standards in the field of information security 8. The device and functioning of modern data encryption systems 9. Requirements for the preservation of state and commercial secrets
	Task 2: Maintenance of special office work and technical documents during operation	**Skills:**
		1. Perform the tasks of receiving, storing, recording, issuing, receiving and disposing of special documents used in the operation of data encryption systems. 2. Interact with organizations that carry out warranty and post-warranty repairs of data encryption systems. 3. Maintain operational documentation of data encryption systems.
		Knowledge:
		1. Rules for conducting special office work and technical documents of data assurance systems. 2. Normative legal acts on the organization of the protection of state secrets, confidential information and the activities of bodies for the protection of state secrets. 3. Organizational measures to protect information in data encryption systems 4. Normative legal acts in the field of information protection. 5. The device and functioning of modern data encryption systems
Labor function 2: Assessing the security level of data encryption systems	**Task 1:** Carrying out control checks of operability and efficiency of data encryption systems	**Skills:**
		1. Determine the functioning parameters of the software and hardware of the data encryption system. 2. Develop methods for evaluating the effectiveness of software and hardware for data encryption systems. 3. Evaluate the effectiveness of software and hardware of data encryption systems. 4. Analyze the software and hardware of data encryption systems in order to determine the level of security and trust they provide
		Knowledge:
		1. Methods and techniques for evaluating the effectiveness of software and hardware for data encryption systems. 2. Principles of building software and hardware for data encryption systems. 3. Methods and tools for assessing the correctness and effectiveness of software implementations of information encryption algorithms. 4. Methods for analyzing program code in order to search for potential vulnerabilities and undocumented features 5. National, interstate and international standards in the field of information security 6. Normative legal acts in the field of information protection 7. Organizational measures to protect information 8. The device and functioning of modern data encryption systems
	Task 2: Conducting security analysis of data encryption systems	**Skills:**
		1. Analyze data encryption systems to determine the level of security and trust. 2. Predict possible ways of developing the actions of an information security violator. 3. Analyze the security policy for adequacy. 4. Monitor, analyze and compare the effectiveness of software and

		hardware in data encryption systems. 5. Compile and draw up an analytical report based on the results of the analysis 6. Develop proposals to eliminate identified vulnerabilities	
		Knowledge:	
		1. Vulnerabilities of computer systems and networks. 2. Cryptographic methods of information protection. 3. Configuration analysis tools 4. National, interstate and international standards in the field of information security 5. Normative legal acts in the field of information protection 6. Organizational measures to protect information 7. The device and functioning of modern data encryption systems 8. Requirements for the preservation of state and commercial secrets	
Requirements for personal competencies	Structural thinking, perseverance and mindfulness Analytical mind, Self-learning ability, Responsibility, Mathematical ability		
Relationship with other professions within the OQF	-	-	
Link to ETKS or KS or other job directories	KS	185. Programming Technician	
Relationship with the system of education and qualifications	The level of education: Higher (5V ISCED code)	Direction of training: Information and communication technologies	Qualification: Bachelor in ICT