6B06122 "INFORMATICS"
MODULAR EDUCATIONAL PROGRAM

Semey, 2021

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Recommended by employers.
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1.EXPLANATORY NOTE

The modular educational program was compiled on the basis of the State Mandatory Standard of Higher Education approved by the Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 604 dated 31.10.2018; in accordance with the Rules of the organization of the educational process on credit technology of training, and the recommendations and wishes of external stakeholders - potential employers were taken into account (presentation webinar "Employer-University-Future specialist" From February 4, 2021 - "UStudy" independent regional testing center of Semey, Educational institution "Innovative College" of Semey".

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The modular educational program was developed as a set of sequential training modules for the entire period of study and is aimed at mastering the competencies necessary for awarding a bachelor's degree in information and communication technologies under the educational program 6B06122 "Informatics".

The modules of the general education disciplines block include disciplines of the mandatory component (MK) – 51 credits and elective components (EC) – 5 credits (Fundamentals of Market Economy and Entrepreneurship, Fundamentals of Law and Anti-Corruption Culture). All disciplines of the general education disciplines block are common to all specialties of education, during the study of which the graduate must master the following competencies: general education, socio-ethical, communicative.

The DB block includes disciplines of the university component (UC) – 45 credits and elective components (EC) - 67 credits. Modules of these disciplines form a set of competencies: economic, organizational and managerial, communicative and professional.

The PD block includes disciplines of the university component (UC) -18 credits and elective components (CV) - 42 credits. Modules of these disciplines allow you to form a complex of special competencies acquired by a graduate. The criterion for the completion of the educational process is the student's mastering of 228 credits of theoretical training and IA - 12 credits. The modular educational program consists of 18 modules that ensure the achievement of the set goals.

- Purpose and objectives of the modular educational program
- The goal is to train highly qualified specialists in the field of IT technologies with higher education, who own the basics of modern mathematical methods, methods of applied mathematics and informatics for solving problems of science, education, technology, economics, management, etc., who have practical skills and leadership qualities, meeting modern requirements for the quality of specialists with higher education.
- Tasks:
- - Providing educational services for the development of professional skills;
- - Formation of the main professional competencies of future bachelors in the specialty "Informatics"";
- - Possibility of multi-level training;
- - Acquisition of skills in working with scientific and technical literature, the use of domestic and foreign experience in professional activities, systematization and generalization of the information received;
- - Learn to analyze and process the results; analyze the state and dynamics of objects of activity in the development of theoretical models that allow predicting the properties and behavior of objects of activity.

Expected results of the modular educational program 6B06122 Computer Science:

ON 1 - identify the main models, methods, tools used in computer systems to automate computer operation and solve intellectual tasks.

ON 2 – compare the current state and trends in the development of computer architectures, computing systems, computing complexes and networks; timely modernization and change of software versions (operating systems, utilities, application software packages, special purpose programs).

ON 3 – to identify problems in the areas of development of programming technology, in the main methods and means of design automation; standard classes of models and methods of modeling complex systems; algorithmic methods for programming languages; problems of a technical, logical nature in the analysis of specific situations for programming, to suggest ways to solve them and evaluate the expected results.

ON 4 – summarize information, prepare references and reviews on professional activities, edit, refer, review texts. Demonstrate knowledge of the documentation requirements accepted in professional communication, understanding of oral speech within professional topics, select the necessary information from foreign language sources.

ON 5 – analyze the results obtained and generalize; assimilation of basic mathematical concepts and methods; classify algorithms for solving formulated problems; analyze the results obtained.

ON 6 – calculate methods of mathematical, simulation and computer modeling of processes and capabilities of computing devices; coordinate indicators for graphic images; have a good understanding of mathematics, statistics and their applications.

ON 7 – classify theoretical and practical problems of computational informatics as areas of knowledge and practical human activity related to the need for information analysis.

ON 8 is a security tool that ensures the smooth operation of modern computing systems; software and hardware complexes and protection systems.

ON 9 – to show the skills of practical implementation of artificial intelligence systems; the capabilities of neural networks; methods of software development for artificial intelligence systems, IT technologies, multimedia technologies and smart technologies.

ON 10 – integrate basic approaches and concepts related to object-oriented software design; structure and design for a web page. Review work with software and development and debugging tools for specialized applications.

ON 11 – choose a database programming environment designed for the development and solution of economic and scientific and technical problems; database models using CASE tools. Confirm the degree of reliability of the results obtained using experimental or theoretical research methods.

ON 12 – describe the procedure for the system analysis of the formulation and formalization of the tasks of the information system, in determining the conceptual model of information systems.

ON 13 – draw conclusions based on the main approaches and concepts related to object-oriented software design. Formulate logical problems and apply mathematical logic tools to solve them.

ON 14 – meet the detailed requirements of a wide range of special-purpose applications, know how they are developed and used in professional activities. Draw conclusions on system analysis, design, coding, debugging and testing, as well as on documentation and release of a software product.

ON 15 – systematize, summarize legal and economic information for use in professional, including entrepreneurial activities. Analyze, summarize economic information and systematize safety standards for use in professional activities.

In order to create special conditions for people with special educational needs to receive education, the graduate's competence model is supplemented with professional competencies that ensure the adaptive nature of the main educational program. For this purpose, courses for the formation of the ability of persons with special educational needs to successfully socialize in society and actively adapt to the labor market, taking into account the characteristics of the disease, are introduced into the catalog of courses of the additional educational program "Minor".

2.The graduate's competence model

Competencies that a graduate of the educational program 6B06122 "Informatics" should have:

Competencies of general education:
- aimed at the formation of ideological, civil and moral positions of the future specialist, competitive on the basis of knowledge of information and communication technologies, building communication programs in Kazakh, Russian and foreign languages, orientation to a healthy lifestyle, self-improvement and professional success;
- form a system of general competencies that ensure the socio-cultural development of the personality of the future specialist on the basis of the formation of his ideological, civil and moral positions;
- develop the ability to interpersonal social and professional communication in Kazakh, Russian and foreign languages;
- contribute to the development of information literacy through the mastery and use of modern information and communication technologies in all areas of their lives and activities;
- form skills of self-development and education throughout life;
- form a personality capable of mobility in the modern world, critical thinking and physical self-improvement;
- to evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical cognition, to reveal the meaning of the content and specific features of the mythological, religious and scientific worldview;
- to show a civic position based on a deep understanding and scientific analysis of the main stages, patterns, peculiarities of the historical development of Kazakhstan, to use methods and techniques of historical description to analyze the causes and consequences of events in the history of Kazakhstan;
- assess situations in various spheres of interpersonal, social and professional communication, taking into account basic knowledge of sociology, political science, cultural studies, psychology, arguing their own assessment of everything happening in the social and industrial spheres, as well as synthesize knowledge of these sciences as a modern product of integrative processes;

- to use scientific methods, methods of research of a specific science, as well as the entire socio-political cluster, to select a methodology, analyze and summarize the results of the study;
- to develop their own moral and civic position on the basis of social, business, cultural, legal and ethical norms of the Kazakh society;
- to put into practice knowledge in the field of social sciences and humanities, which has worldwide recognition, synthesize new knowledge and present it in the form of humanitarian socially significant products;
- to engage in communication in oral and written forms in Kazakh, Russian and foreign languages, using language and speech means based on grammatical knowledge to solve problems of interpersonal, intercultural and industrial (professional) communication, as well as to analyze information, actions and deeds of communication participants in accordance with the communication situation;
- to use various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services for the search, storage, processing, protection and dissemination of information;
- to build a personal educational trajectory throughout life for self-development and career growth, to focus on a healthy lifestyle to ensure full-fledged social and professional activities through methods and means of physical culture;
- to know and understand the basic laws of the history of Kazakhstan, the basics of philosophical, socio-political, economic and legal knowledge, communication in oral and written forms in Kazakh, Russian and foreign languages;
- apply the acquired knowledge for effective socialization and adaptation in changing socio-cultural conditions, possess the skills of quantitative and qualitative analysis of social phenomena, processes and problems.

Basic competencies:
- to use fundamental concepts of mathematics in professional activity;
- carry out the proof of mathematical statements, solve mathematical problems and problems, identify their essence, translate problems into mathematical language;
- to use the basic concepts and methods of discrete mathematics, the basics of mathematical logic, methods of probability theory and mathematical statistics in the study of mathematical models of the subject area;
- use methods for constructing various models of data types, algorithms for information processing;
- rationally use the opportunities provided by the algorithmization technique to solve practical problems;
- assessment (to evaluate) the level of reliability of the results obtained using experimental or theoretical research methods;
- conducting qualitative mathematical research based on mathematical analysis;
- build mathematical models, set mathematical problems, choose suitable mathematical methods and algorithms for solving problems, use numerical methods using modern computational methods to solve problems;
- work with various operating systems and their administration;
- development of a database for solving economic, scientific and technical problems;
- configuring the security features installed in the operating system;
- installation of operating systems;
- basic methods of data collection and processing in Python, gaining an understanding of how to work with the Python programming language.
- timely upgrade and replacement of software versions;
- develop and implement in the form of a software module an algorithm for solving a theoretical or applied problem based on a mathematical model;
- practical implementation of the artificial intelligence system;
-the main methods of solving artificial intelligence problems and the role of logic programming.

Professional competencies:
- apply modern methods of object-oriented programming when coding software systems of various levels of complexity;
- apply system analysis in setting tasks and algorithmization of an information system, defining a conceptual model of information systems;

- use basic visual techniques and materials;
- use computer graphics tools in the process of design design;
- designing a BP model using case tools;
- develop the structure and design of a web page;
- work in an algorithmization and programming environment;
- system analysis in the formulation and formalization of information system tasks, definition of the conceptual model of information systems;
- work with raster, two-dimensional and three-dimensional vector graphics software;
- work with tools for processing and debugging client and server clocks of Internet applications.
- creation of various programs using fundamental computational algorithms;
- system analysis, design, coding, debugging and testing, software product release;
- creation and formatting of HTML files;
- sample classes and methods for modeling complex systems;
- methods of designing interface components;
- construction of parallel analogs of computational algorithms;
- a web page creation tool;
- practical implementation of the artificial intelligence system;
- develop web scripts to program in PHP;
- simulation of physical situations using a computer;
- features of business communication in English, Kazakh and Russian for professional use in the future field of activity.
- install, configure, use and interact with the relational database management system to present data using various models, to make SQL queries;

Table 1. The sequence of mastering disciplines in the process of forming special competencies

№	Competencies	The list of compulsory, elective disciplines and the sequence of their study		Expected results
		List of disciplines	The sequence of their study (sem.)	
1	Special competencies	Object-oriented programming / Programming in Embarcadero Delphi XE development environment	7	**Know:** what is an object and a class, the basic principles of object-oriented programming, the principles of building classes, the criteria for verifying the correctness of the formation of classes, the main trends in the development of technologies of object – oriented programming. **To be able:** to apply modern methods of object-oriented programming at coding of program systems of various levels. **Skills:** working with visual programming environment C++ Builder
				Know: SQL Server, Oracle, Multi-Device, SQLite, 3D Graphics, Float and Path animation. **To be able:** compose cyclograms from methods in Delphi applications. **Skills:** advanced code formatting settings.
2		Informational systems / The theory of information systems	5	**Know:** the composition and structure of information systems, hardware and software and have an idea of the structure of the information process, know the basics of information processes; **To be able:** use the system analysis in the formulation and algorithmization of information system problems, determine the conceptual model of information systems; **Skills:** system analysis in the formulation and formalization of information system tasks, the definition of a conceptual model of information systems.
				Know: basics of organization of information processes; know the methods of formalized description of information processes and objects, the main phases of the principles of its application in the development of computer technology and software; **To be able:** apply basic models and means of information transmission to optimize modern computer systems. **Skills:** understanding the basic concepts of information theory: classification and measurement of information, transmission speed and mathematical models of signals

3		3D graphics and animation	3	**Know:** current trends in the development of graphics and design; the field of use of computer graphics; architecture of the main hardware and software tools for working with network technologies; color representation model. **To be able:** use basic visual techniques and materials; use computer graphics tools in the process of design design. **Skills:** working with raster, two-dimensional and three-dimensional vector graphics software; basic functionality of modern graphics systems; organization of dialogue in graphics systems.
4		Database programming / Programming in PHP	8	**Know:** the basic concepts of building database models, methods and tools for designing relational databases, especially the preparation of programs for interaction with databases, database organization, ways to protect data by DBMS, the basics of differentiation of access rights, the basics of SQL language for working with data organized in the form of a relational database; **To be able:** program databases in different programming environments; **Skills:** development of database software designed to solve economic, scientific and technical problems.
				Know: the language of programming PHP, developing skills of designing and programming web applications **To be able:** apply PHP programming language to develop web application. PHP language was created to solve a specific practical problem in the Internet environment. **Skills:** designing a web application using theoretical and practical skills in PHP programming environment
5		Methods of teaching Informatics / Methods and technology of teaching Informatics	8	**Know:** the basic concepts of teaching computer science, programs and textbooks developed on their basis; the value and ways of differentiated and specialized training in the basics of computer science; requirements for the computer science classroom at school and the organization of work in it; the content of the teacher's work on the organization, planning and provision of computer science lessons. **To be able:** formulate the objectives of the lesson; plan the learning process based on the goals of the topic or lesson, to predict the cognitive activity of students; select training material and learning tools for the lesson in accordance with its objectives; plan the study of educational material during the year, topics. **Skills:** basic methods of studying concepts, means of training, forms, methods and means of control and assessment of knowledge; technologies of teaching Informatics
				Know: Technology and methodology for the study of information processes. Technology and methodology of studying the basics of algorithmization. **To be able:** Technology and methods of studying the device computer. Computer simulation.

				Skills: Software and mathematics.Means of Informatization.Social Informatics.Theoretical Informatics.

Table 2. Mastering the disciplines of social and professional interaction sequence

Well	Disciplines that provide	Competencies	Expected Result
		General education disciplines	
		Required Component	
1	Modern history of Kazakhstan	Socio-ethical competencies	**Know:**social and ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities; know the traditions and culture of the peoples of modern Kazakhstan. **Be able to:** coordinate the theoretical, specifically - historical, source study and historiographical aspects of the study of the history of Kazakhstan. **Skill:**analytical and axiological analysis in the study of complex historical processes, phenomena and historical figures of modern Kazakhstan.
1	Information and Communication Technologies (in English)	Information and communication competencies	**Know:**what economic and political factors contributed to the development of information and communication technologies; features of various operating systems; **Be able to:**determine the main trends in the field of information and communication technologies; use information resources to search and store information; working with spreadsheets, grouping data, creating graphs; application of methods and means of information protection; designing and creating simple websites; carrying out processing of vector and raster images; creation of multimedia presentations; use of various platforms for communication; calculation and evaluation of performance indicators of supercomputers; the use of various forms of e-learning to expand professional knowledge; use of various cloud services. **Skills:**database structure development; designing and creating presentations; receiving data from the server; creating video files; work with Smart-applications; work with services on the e-government website.
1.2	Foreign language	Competencies in the field of language	**Know:**basic definitions in the field of the English language, contributing to the formation of a highly educated personality with a broad outlook and a culture of speech; scientific vocabulary and scientific structures of a technical profile in English; rules for depicting texts of various genres; speech norms of the sphere of technical activity;

			basics of business communication.
			Be able to:conduct a free conversation on various topics; use reference literature in English; express their opinion from the point of view of a future specialist in the field of professional activity. use of reference literature in English (explanatory dictionaries, reference books, encyclopedias));
			Skills:competent interpretation in English; competent compilation of the current thought documentation in Kazakh English; building a constructive dialogue; expressing one's opinion in English from the point of view of a future specialist in the field of professional activity.
1.2	Kazakh (Russian) language	Competencies in the field of language	**Know:**basic definitions that contribute to the formation of a highly educated personality with a broad outlook and a culture of speech in the field of the Kazakh (Russian) language; scientific vocabulary and scientific constructions of a technical profile in the Kazakh (Russian) language; rules for depicting texts of various genres; norms of speech in the field of technical activity; basics of business communication. **Be able to:-** to conduct a free conversation on various topics; - use reference literature in the Kazakh (Russian) language; - Express your opinion from the point of view of a future specialist in the field of professional activity. **Skills:**competent interpretation in Kazakh (Russian) language; competent compilation of the current thought documentation in the Kazakh (Russian) language; building a constructive dialogue; expressing one's opinion in the Kazakh (Russian) language from the point of view of a future specialist in the field of professional activity.
2	Philosophy	Socio-ethical competencies	**Know:**the main directions, problems, theories and methods of philosophy, the content of modern philosophical discussions on the problems of socio-philological development. **Be able to:**formulate and reasonably defend their position on various issues of philosophy; apply the provisions and categories of philosophy to evaluate and analyze various social processes, facts and phenomena. **Skills:** public speaking, argumentation, discussion and controversy, crown analysis of the logic of various thoughts; written reasoned presentation of their point of view, critical perception of information.
	Political Science / Sociology / Culturology / Psychology	Socio-ethical competencies	**Know:**the main content of the course "political science"; * mastery of fundamental knowledge of political theory; * the range of achievements of historical thought in the field of studying ancient culture. **Be able to:-** independently work with literature of a general humanitarian nature, find key worldview problems and solve them; - think logically, systematically and critically; - to use the luggage of philosophical erudition acquired for the formation and argumentation of one's own judgments on various everyday issues.

			Skill: general education.
			Know:- laws of development and functioning of society; - features of the analysis of the modern system of social inequality, social mobility and stratification; **Be able to:** use basic knowledge in the field of humanities and economic sciences in cognitive and professional activities; **Skill:** practical skill of using the knowledge gained in the analysis of specific social situations.
			Know: the structure and composition of modern cultural education; cultural studies and philosophy of culture; sociology of culture, cultural anthropology; cultural studies and cultural history; **Be able to:** distinguish between the basic concepts of cultural studies: the dynamics of culture, symbols of language and culture, cultural codes, intercultural communication, cultural values and norms, cultural traditions, cultural picture of the world, institutions of social culture **Skill:** practical skill of using knowledge in the analysis of specific social situations.
			Know: the essence of the basic psychological processes and properties, mental states that ensure human life; be able to apply in the practice of activity the main methods of psychology and taking into account their economic specifics; psychological theories of personality, group and collective. **Be able to:-** use the acquired knowledge of psychology in their practical activities; - organize individual and group activities of people, taking into account their psychological characteristics and compatibility; - competently use communicative competence in the course of group joint activities. **Skill:** develop memory, thinking, analyze and generalize

Selectable Component

2	Fundamentals of market economy and entrepreneurship	Competence of general education	**Know:** -basic patterns of interaction between nature and society; - fundamentals of functioning of ecosystems and development of the biosphere; - the impact of harmful and dangerous factors of production and the environment on human health; - concept, strategy, problems of sustainable development and practical ways to solve them at the global, regional and local levels; - principles of organization of safe production processes. **Be able to:** assess the ecological state of the natural environment; assess the technogenic impact of production on the environment; critically comprehend the trends in the development of ecological and economic systems associated with the use of natural resources, and characterize their environmental consequences. **Skills:** study of the components of the ecosystem and the biosphere as a whole; determination of optimal conditions for sustainable development of ecological systems; conducting logical discussions on topics related to the solution of environmental problems; search and systematization of standard methods of environmental monitoring; scientific and special literature.
2	Fundamentals of law and anti-corruption culture	Competence of general education	**Know:** As a result of studying the discipline, students should know: the essence of corruption and the reasons for its origin, the measure of moral and legal responsibility for corruption offenses. **Be able to:** possess the skills to acquire new knowledge about the anti-corruption culture is a holistic interdisciplinary system of knowledge. **Skills:** general education.
2	Fundamentals of life safety and ecology	Competence of general education	**Know:** the science of comfortable and safe interaction of a person with the technosphere is a field of scientific knowledge that develops ways to protect against them in any conditions that pose a danger to a person and inhabiting a person. **Be able to:** identify risks and quantify negative environmental impacts; predicting the development of these side effects; and assessment of the consequences of their impact; elimination of negative consequences of exposure to hazardous and harmful factors. **Skills:** socio-ethical
	Basic disciplines		
	Required Component		
2	Professional Kazakh (Russian)	Competence in the	**Know:** scientific vocabulary of a technical profile and scientific structures; rules for depicting

	language	field of language	texts of various genres; language norms in the field of technical activity; basics of business communication. **Be able to:** choose language means, build statements taking into account literary norms and the communicative situation; distinguish between the logical and compositional structure of a scientific test, master oral public statements (message, dMKlad), analyze listened public speeches; communicate professionally; use dictionaries and correctly interpret the information received from them about language units; extract the read or listened text from the educational, professional, socio-cultural spheres, indicating the necessary information and presenting it in a certain sequence. **Skills:**work with scientific and technical literature; independent search for scientific and technical information as the basis of professional activity; listening to and fully understanding the declared information at a normal pace with the subsequent transmission of its content; conducting dialogues of interviews, surveys and conversations.
2	Professionally-oriented foreign language	Competence in the field of language	**Know:**functional features of oral and written texts of a scientific and technical nature in the specialty; requirements for registration of admission in professional communication; strategy of communicative behavior in the conditions of professional communication. **Be able to:-** understand oral speech within the framework of a professional topic; - provide clarifications when discussing topics related to the profession; - independently prepare and compose oral reports on professional topics using multimedia technologies; - obtain the necessary information from other language sources created in various sign systems (text, table, graph, diagram, audiovisual series, etc.); - annotate, abstract and present in the native language the main content of the literature on the specialty, if necessary; writing messages, articles, abstracts, abstracts on professional topics. **Skills:**own the basic grammatical constructions characteristic of oral and written professionally oriented communication;
one	Mathematics 1.2	Competences of natural sciences	**Know:**basic fundamental concepts of mathematics; circuit theory; theory of continuous functions; Landau symbol, differential calculation of functions of one real variables, basic formulas and theorems of integral calculus, integrals of the first and second kind: **Be able to:-** find specific faces of numerical sets; - to investigate the sequence for similarity; - explore the presence of a limit at a point, continuity at a point and a set; - explore the function using the derivative and build a graph of the function, apply various integration methods, apply certain integrals; - explore and calculate integrals of the first and second kind; **Skill:**solving applied problems by transferring data to classical mathematical problems; finding optimal methods for solving practical problems; methods for solving differential and integral

			problems.
2	Algorithmization and programming bases	Professional competencies	**Know:**algorithmic methods of algorithms; structural features, organization and practical implementation of algorithms; bases and prospects for the development of new technologies. **Be able to:**consider the properties of algorithms and situations in which these algorithms can be useful; create various programs using fundamental computational algorithms and their properties, leading to a linear, branched and cyclic type of algorithms; process arrays using various internal sorting methods; explore related to the analysis of algorithms; analyze the effectiveness of algorithms; practice the construction of models and data structures, conduct a subsequent analysis of the results. **Skills:**development of algorithms and programs for solving problems; practical work on the use of modern software, modern computer technology;
2	Programming languages and technologies	Professional competencies	**Know:**basic elements of a programming language: data types, operators; library functions capabilities, abstract and user-defined types, structures, functions, etc.; programming language development trends and scope; software development tools; ergonomic, aesthetic, psychological requirements for software; methods of structural analysis. **Be able to:**conduct system analysis, design, coding, configuration and testing, consolidation and output of the software product; conduct a primary analysis and evaluate the results of the identified limitations; look for critical points of view of the project **Skills:**the basics of automating problem solving, skills in working with modern programming languages and their tools and the capabilities of an integrated processing environment.
2	Operating systems	Professional competencies	**Know:**fundamental principles of designing operating systems; purpose, functions, classification of operating systems; principles of computer resource management; the concept of multiprogramming, processes and threads; principles of virtualization and mobility of operating systems. **Be able to:**implement basic algorithms for scheduling and synchronizing processes and threads, memory management, disk scheduling; develop multi-threaded applications; take into account the features of work in a particular operating system; use operating system tools. **Skills:**installing operating systems, managing accounts, configuring the user's working environment, connecting and configuring hardware devices, managing disks and files with systems, configuring network settings.

3	Computer networks	Professional competencies	**Know:**evaluation and control of LAN performance; computer, server equipment and peripheral devices, types of their compatibility, technical characteristics; resource management; calculation of costs for the design and installation of LAN. **Be able to:**organize updating of software versions; development of regulations for the organization for servicing the LAN; control software version updates; develop a preventive action plan. **Skills:**own: methods of building a network; current protocols and their features; skills about network optimization methods
3	Managing datebases	Professional competencies	**Know:**principles of organization of modern databases and database systems; main categories and the concept of a database; relational data format; database design methods; **Be able to:-** build the form of the subject area and create databases associated with it; organize the processing of information in the database; organize the maintenance of the integrity of the database. **Skills:**work in a special database management system, training in the creation of basic objects in the database; distribution of the main functions, the need to release the task; creating applications in the database..
	Basic disciplines		
	Selectable Component		
1	Computer architecture/ Techics of computer and communication systems	Professional competencies	**Know:**basic principles and basic concepts of building the architecture of computing systems; types of computing systems and their architectural features; the principle and organization of the work of the main logical blocks of computer systems; information processing processes at all levels of computer architecture; main components of computer systems software; basic principles of resource management and organization of access to these resources. **Be able to:** receive information about the parameters of the computer system.; adding additional coverage and setting up communication between elements of a computer system; Installation and configuration of software for computer systems. **Skills:**analysis of computer operation, modernization of computer hardware.
			Know: about the hardware of computer and communication systems, as well as their technical characteristics and functionality. **Be able to:**apply knowledge and skills in the preparation of applied practical problems using the technology of computer and communication systems. **Skill:**use of basic means of computer and communication systems technology
2	Application packages program / applied software	Professional competencies	**Know:**the concept of an application package; the stages of development of an application package; the concept of office application packages; the concept of desktop printing systems;

			the concept and purpose of technical means of a printing system; the basics of working with the adobepagemaker printing system. **Be able to:**classify software products depending on their purpose; create application software packages; create texts with publications in Adobe PageMaker; work with adobepagemaker objects; format texts adobepagemaker. **Skills:**creation of publications by means of the Microsoft Word program with layout and layout capabilities; creating documents in Microsoft Office Publisher; creating booklets and layout layouts in Microsofficepublisher; working in printing systems; working with objects, text and techniques in Adobe PageMaker; creating and receiving multi-page publications in Adobe PageMaker.
			Know: classification of system and application software; theoretical foundations of applied software; tasks and possibilities of basic and applied computer software. **Be able to:**apply application software, covering all the possibilities and purpose of the basic and application software of a computer. **Skills**:modeling methods, information technology, management
2	Information resources / information resources and technologies	Professional competencies	**Know:**principles of work with information resources and systems; the basics of the organization and functioning of the Internet connection; ways of using information and communication services of the Internet; **Be able to:**create and format HTML documents; create text with links to other hypertext documents; use information resources to obtain the necessary information; **Skills:** work with browsers; search and analysis of information resources; methods and techniques for creating hypertext documents; methods for searching and analyzing information on the Internet; work with modern information resources.
			Know: ways of using information and communication services on the Internet; Internet technologies as an infrastructure for conducting electronic business; the structure of the information environment or information space, including information flows: various information systems and information resources: principles and methods of using technical devices; **Be able to:** search for information on the Internet; classify information systems and distinguish their characteristic features; evaluate the quality and efficiency of information resources use: **Skills:** methods of searching and analyzing information on the Internet; search for information from various sources; analysis of relevant information, specification of demand in order to increase search efficiency; work with modern information resources.
2	Discrete mathematics / math statistics	Professional competencies	**Know:** algebraic methods for describing models.; elementary functions, properties of the algebra of logic and their analytical expression; basics of logical calculation of words and

			predicates; methods for solving classical problems formulated in terms of combinatorics **Be able to:** apply combinatorial configurations to solve problems, determine the type of a binary relation and its properties, perform sets, represent columns in various ways, perform operations on graphs, find the shortest path to graphs, compile a truth table of a Boolean function, perform similar transformations, find SDNF, SKNF, determine the minimum DNF. **Skills:** using the basic tools of discrete mathematics to solve applied problems; methods of construction, analysis and application of discrete models in professional activities.
			Know: the methodology for estimating the probability of the main numerical characteristics of random variables; verification of the hypothesis about the parameters and distribution laws of random variables; **Be able to:** calculate the probability of a random event; **Skill:** calculation of numerical characteristics of random variables;
3	Theory of languages and automata / algorithmic languages and programming	Professional competencies	**Know:** basic concepts of formal languages and automata theory; algorithmic languages; basics of programming **Be able to:** analyze basic information about tasks that require the creation of formal languages, write formal definitions of such languages, create and analyze tools for the algorithmic analysis of such languages; programming in various algorithmic languages. **Skill:** solving problems that arise in the design and implementation of software projects aimed at creating compilers and other tools for processing formal languages.
			Know: algorithmic methods; features of the structure, organization and practical implementation of algorithms; fundamentals and prospects for the development of new technologies **Be able to:** consider the properties of algorithms and situations in which these algorithms can be useful; create various programs using fundamental computational algorithms and their properties, leading to a linear, branched and cyclic type of algorithms; process arrays using various internal sorting methods; explore related to the analysis of algorithms; analyze the effectiveness of algorithms; apply in practice the construction of models and data structures, conduct a subsequent analysis of the results. **Skills:** development of algorithms and programs for solving problems; practical work on the use of modern software, modern computer technology
3	SOFTWARE development basics / Computer Software	Professional competencies	**Know:** software lifecycle; computer-aided design and software development technologies. Methods of organizing work in software development teams. **Be able to:** Apply modern IP and ICT in the management of software development projects, identify problems and trends in the development of the software market **Skills:** work with automated software development tools, support for collective software

			development.
			Know: the main types of software and their purpose; ways to configure the software; **Must be able to:** perform project work using the most common software packages; **Skills:** the skills of working with software and using software tools to solve applied problems.
3	Robotics and the basics of artificial intelligence / robotic systems and complexes	Professional competencies	**Know:** methods for constructing data structure-oriented algorithms **Be able to:** competently create and correct programs, design programs, express your opinion using the program. mastering the basic principles of building and using modern algorithms and programs for solving problems in computer science using various techniques; **Skills:** programming; studying the basics of modern programming languages and describing programming systems, developing creative thinking and skillful application in practice
			Know: methods for constructing data structure-oriented algorithms **Be able to:** competently create and correct programs, design programs, express your opinion using the program. mastering the basic principles of building and using modern algorithms and programs for solving problems in computer science using various techniques; **Skills:** programming; studying the basics of modern programming languages and describing programming systems, developing creative thinking and skillful application in practice.
3	Computing modelling / Mathematical and computer modeling	Professional competencies	**Know:** model classes of models and methods for modeling complex systems, the apparatus of the Monte Carlo method, the principles of constructing models of the processes of functioning of complex systems, methods of formalization and algorithmization; **Be able to:** apply a systematic approach in the study, design and operation of information systems, develop modeling algorithms and implement them using algorithmic languages and modeling application packages, automate the design process using modeling databases. **Skill:** using computer simulation tools to create the user's psychological comfort.
			Know: methods for solving basic mathematical problems - integration, - differentiation, solving systems of equations using linear and transcendental equations and computers; basic principles for constructing mathematical models; main types of mathematical models. **Be able to:** develop algorithms and programs for solving computational problems, taking into account the required accuracy of the result; choose analytical methods for studying mathematical models; apply numerical methods for studying mathematical models. **Skill:** solve computational problems using computer simulation.
3	Programming in Python 3 / Basics of programming Python	Professional competencies	**Know:** paradigms, architectural features, semantics and syntax of the Python programming language, purpose, structure and properties of the main structures and constructions of the Python language, modules and packages for solving various applied and scientific problems. **Be able to:** - develop mathematical methods and algorithms for solving various problems, - use an integrated development environment for developing and debugging a program.

			Skills: Ability to read, write, debug, and test programs in a high-level programming language in an integrated design environment.
			Know: develop skills in the Python programming system. **Be able to:** program algorithmize in the development of thinking. ICT at the professional level. Modeling as a means of knowledge. Machine learning, data analysis and visualization. **Skill:** comparing various URLs with parts of Python code, working with databases, creating HTML representations for display on user devices.
3	Numeral methods / Metfods of optimization and research operations	Professional competencies	**Know:** the basics of the theory of errors and the theory of approximation; basic numerical methods of algebra; methods for constructing elements of the best approximation; methods for constructing interpolation polynomials; methods of numerical differentiation and integration; methods of numerical solution of simple differential equations; methods of numerical solution of partial derivatives of differential equations.; **Be able to:** solve algebraic and transcendental equations in numerical form, using for this the consequences of the theorem on compression images .; **Skill:** practical assessment of the accuracy of the results obtained in solving computational problems based on approximation theory; technologies for applying computational methods to solve specific problems from various areas of mathematics and its applications.
			Know: methods of optimizing functions. Methods for searching for extremums of a function of one variable. **Be able to:** apply optimization techniques to complete tasks **Skill:** the technology of applying computational methods to solve specific problems from various areas of mathematics and its applications.
4	Object Oriented Programming / Programming in Embarcadero Delphi XE development environment	Professional competencies	**Know:** what is an object and a class, the basic principles of object-oriented programming, the principles of building classes, the criteria for checking the correctness of building classes, the main trends in the development of object-oriented programming technologies. **Be able to:** apply modern methods of object-oriented programming when coding software systems of various levels. **Skill:** Working with C++ Builder visual programming environment.
			Know: basic principles of object-oriented programming, principles of building classes, SQL Server, Oracle, Multi-Device, SQLite, 3D graphics, float and Path animation. Programming in the Embarcadero Delphi XE environment. **Be able to:** create cyclograms from methods in Delphi applications. **Skill:** Advanced code formatting options.
4	Hardware and software protection of information /	Professional competencies	**Know:** basic concepts and directions in the protection of computer information, principles of information protection, examples and principles of classification of threats to the security of

	Information security		computer systems; methodology for evaluating the results of applying organizational and technical solutions to ensure information security. **Be able to:** configure the security tools installed in the operating system, analyze the security of the computer and the network environment using a security scanner; installation and use of one of the tools for encrypting information and organizing data exchange using an electronic digital signature; assessment of the effectiveness of the applied hardware and software to ensure information security. **Skills:** auditing the security of information systems, methods of system analysis of information systems; monitoring the implementation of plans for technical counteraction to threats to information of the organization.
			Know: methodology for analyzing the effectiveness of the software; Basic concepts, goals and objectives for the enterprise; essence and components of software; principles of organization and stages of software development; factors affecting the organization. **Be able to:** analyze the effectiveness of the software; use the principles of organization and stages of software development; identify factors that affect the organization **Skills:** auditing the security of information systems, methods of system analysis of information systems
4	Methods of teaching Informatics / methods and technology of teaching informatics	Professional competencies	**Know:** the basic concepts of teaching computer science, programs and textbooks developed on their basis; the essence and ways of differentiated and specialized education in the basics of computer science; requirements for the classrooms of computer technology in the school and the organization of work in it; the content of the teacher's work in organizing, planning and providing informatics lessons. **To be able to:** formulate the purpose of the lesson; - plan the educational process taking into account the goals of the topic or lesson, predict the cognitive activity of students; - select educational material and teaching aids for the lesson in accordance with its objectives; - plan the study of educational material during the year, topics. **Skills:** basic approaches to mastering concepts, teaching aids, forms, methods and means of monitoring and evaluating knowledge, technologies for teaching informatics
			Know: technology and methods of teaching information processes. Technology and methods of teaching the basics of algorithmization. **Be able to:** apply technology and teaching methods. Computer modelling. **Skills:** software and mathematical software. Informatization tools. Social informatics. Theoretical informatics.

		Professional disciplines	
		Required Component	
2	3D graphics and animation	Professional competencies	**Know:** current trends in the development of graphics and design; area of use of computer graphics; the architecture of the main hardware and software tools for working with network technologies; color representation model. **Be able to:** use the basic visual techniques and materials; use computer graphics tools in the design process. **Skills:** work with raster, two-dimensional and three-dimensional vector graphics software; basic functionality of modern graphic systems; organization of dialogue in graphic systems.
3	Information management	Professional competencies	**Know:** about risks; subject and information technologies; information systems, decision-making process, functional IT, IT structure; place of IP at a manufacturing enterprise, functional sections of IP; **Be able to:** assess the expected risks of acquiring IP, implement IP and use IP; analyze the control system for subsequent automation; **Skill:** identifying information management problems and how to solve them.
		Component of choice	
3	Information systems / The theory of information systems	Professional competencies	**Know:** the composition and structure of information systems, hardware and software and an idea of the structure of the information process, know the basics of organizing information processes; **Be able to:** apply system analysis in setting and algorithmizing the tasks of an information system, determine the conceptual model of information systems .; **Skill:** system analysis in setting and formalizing the tasks of an information system, defining a conceptual model of information systems.
			Know: the basics of organizing information processes; methods of formal description of information processes and objects, principles of its application in the development of computer technology and software; main stages; **Be able to:** apply the basic models and means of information transmission to optimize modern computer systems. **Skills:** Basic concepts of information theory: the concept of classification and measurement of information, transmission speed and mathematical models of signals.
3	Web development / programming technology	Professional competencies	**Know:** HTML hypertext markup language; basics of working with programs for creating web pages programming languages Java Script, VRML **Be able to:** plan the amount of work when developing a Web page; develop the structure and design of the Web page; create web pages in the JavaScript programming language; publish

			pages on the global Internet. **Skill:** working with the means of processing and debugging the client and server parts of Internet applications.
			Know: programming languages and technologies **Be able to:** plan and organize a scientific, creative approach to the development of tools and methods, programming technologies **Skills:** as a result of studying the discipline, the student must master the skills of compiling, setting up and testing the program, as well as developing and operating interface objects.
3	The theoretical basis for the development and implementation of programming languages / SQL language	Professional competencies	**Know:** the basics of task algorithmization, methods of programming automation; data types and operator types of the C++ language; subroutines, standard library functions. Methods for building programs using standard library modules, dynamic data structures; methods for correcting errors in programs and their implementation. **Be able to:** create reporting programs for processing one-dimensional and two-dimensional arrays, string data; create programs using procedures, functions, and standard modules; program tasks for processing data structures stored on external media. **Skills:** drawing up block diagrams of various algorithms; development of linear, branched, cyclic structures of algorithms; organizing the data structure required by the report; development and testing of programs using the means of the programming language; development and design of programs in the environment with ++; Programming skills in C++ in the Microsoft Visual C++ integrated environment.
			Know: the basic provisions of the theory of databases, data warehouses, knowledge bases; basic principles of building a conceptual, logical and physical database model; modern tools for developing database schemas.; **Be able to:** create database objects in modern database management systems and manage access to these objects; work with modern case database design tools; create and correct database schemas; develop application programs using the SQL language; **Skills:** work with database objects in a specific database management system; use of database filling tools; applying standard methods for protecting database objects.
4	The theory of programming languages and translation methods / high-level programming language	Professional competencies	**Know:** the main provisions of the theory of formal Grammars of programming languages, automata, methods of parsing and translation of formal grammar classes used to describe the basic structures of programming languages.; **Be able to:** formally describe the syntax and semantics of simple procedural and domain-oriented programming languages, develop parsing algorithms for commonly used formal grammars, use standard terminology. reading scientific articles and using literature for independent solution of research problems

			related to the development of languages and methods of translation; **Skills:** to apply the main methods of methodological approaches and promising areas of work in the field of formal methods for describing and translating languages.
			Know: a formal description of the syntax and semantics of simple procedural and domain-oriented programming languages, the development of parsing algorithms for the most commonly used formal grammars, the use of standard terminology definitions. **Be able to:** create a document structure, use basic language tags, use tags to format a document, use META instructions, embed videos, create lists, use hyperlinks, use CSS, use a div element, create a registered design site structure, create a Rubber Design website structure, add JS files, use functions and scripts, work with situation statements, use loop statements, work with loop arrays. **Skills:** creation of web-pages, imposition; using css styles, creating interactive; writing scripts in the JavaScript client-side programming language
4	Parallel computing / Multiprocessor computer systems and parallel programming	Professional competencies	**Know:** create and program software products using the main models of parallel computers; the basics of parallel data processing **Be able to:** apply parallel algorithms in programming languages such as MPI, OpenMP, PVM **Skill:** building parallel analogues of computational algorithms.
			Know: an efficient parallel computing algorithm for solving applied problems. **Be able to:** apply computer technology in the automation system; **Skill:** selection of optimal network technologies for information support of the control system
4	Systems of artificial intellect / Theory of artificial intellect	Professional competencies	**Know:** the history of the development of systems and methods of artificial intelligence; tasks solved by artificial intelligence methods; classification of artificial intelligence systems; artificial intelligence languages. • **Be able to:** teach artificial intelligence systems; choose artificial intelligence methods for solving practical problems; calculate predicates; create computer programs using object-oriented programming methods to solve practical problems using artificial intelligence methods. **Skills:** practical implementation of the artificial intelligence system; visual demonstration of the results obtained by artificial intelligence methods; application of artificial intelligence applications; development of computer programs for solving practical problems using artificial intelligence methods.

			Know: the history of the development of artificial intelligence; tasks solved by artificial intelligence methods; classification of artificial intelligence systems; artificial intelligence languages. • **Be able to:** teach artificial intelligence systems; choose artificial intelligence methods for solving practical problems; calculate predicates; create computer programs using object-oriented programming methods to solve practical problems using artificial intelligence methods. **Skills:** practical implementation of the artificial intelligence system; visual demonstration of the results obtained by artificial intelligence methods; application of artificial intelligence applications; development of computer programs for solving practical problems using artificial intelligence methods.
4	Graphic and multimedia design / multimedia software	Professional competencies	**Know:** digital video and sound for the development of design projects and presentations of design objects; functionality of modern programs used to create multimedia products; **Be able to:** implement, store, process, transmit and publish digital information, including audio, video, video and multimedia products on a personal computer and global computer networks; store finished multimedia products on modern storage devices. **Skill:** programming in Flash Professional environment. methods and means of creating modern multimedia products
			Know: digital video and sound for the presentation of design objects and the development of design projects; functionality of modern programs used to create multimedia products.; **Be able to:** implement, store, process, transmit and publish digital information, including audio, video, video and multimedia products on a personal computer and global computer networks; store finished multimedia products on modern storage devices. **Skill:** programming in Flash Professional environment. methods and means of creating modern multimedia products
4	Database programming / programming in PHP	Professional competencies	**Know:** the basic concepts of building database models, methods and tools for designing relational databases, the features of building programs for interacting with databases, the organization of a DBMS, ways to protect data using DBMS, the basics of restricting access rights, the basics of the SQL language for working with data organized in the form relational databases; **Be able to:** program databases in a programming environment; **Skill:** development of database software for solving economic and scientific and technical problems.

			Know: knowledge of the PHP programming language, development of skills in designing and programming web applications; **Be able to:** use the PHP programming language to develop web applications. The PHP language was created to solve specific practical problems in the Internet environment. **Skill:** designing web applications using theoretical and practical skills in the PHP programming environment					

Table 3. List of modules included in the educational program

Module No.	Module name	List of disciplines included in the module	Block	Semester	Amount of credi	form of control	ll credits for th module
M.1	Computer and Information Technology	Information and Communication Technologies (in English)	GED	1	5	Ex..	9
		Computer Architecture / Computer and Communication Systems Engineering	BD	1	4	Ex..	
M.2	Mathematics	Mathematics 1	BD	1	5	Ex..	8
		Mathematics 2	BD	2	3	Ex..	
M.3	Fundamentals of bilingual	Foreign language	GED	1.2	10	Ex..	20

	literacy	Kazakh (Russian) language	GED	1.2	10	Ex..	
M.4	Historical and social sciences	Modern history of Kazakhstan	GED	2	5	GE	5
M.5	Worldview	Philosophy	GED	4	5	Ex..	
		Political Science	GED	2		Ex..	
		Sociology	GED	2	8	Ex..	16
		Culturology	GED	one		Ex..	
		Psychology	GED	one		Ex..	
		Physical Culture	GED	1,2,3,4	8	Ex..	
M.6	Fundamentals of Economics	Fundamentals of market economy and entrepreneurship	CC	2	5	Ex..	5
M.8	Training program	Educational practice	OCT	2	1	Russ	
		Programming languages and technologies	BD	3	6	Ex..	13
		Application package / application software	BD	3	6	Ex..	
M.9	Professional languages	Professional Kazakh (Russian) language	BD	3	3	Ex..	6
		Professionally oriented foreign language	BD	3	3	Ex..	
M.10	Programs and systems	Operating Systems	HELL	4	5	Ex..	
		Educational practice	BD	4	2	OCT	
		Computer network	BD	5	5	Ex..	17
		Fundamentals of Software Development / Computer Software	BD	5	5	Ex..	
M.11	Information technology programming	Informational resources/Information Systems	BD	4	5	Ex..	
		Fundamentals of robotics and artificial intelligence / Robotic systems and complexes	BD	5	5	Ex..	
		Computer modeling / Mathematical and computer modeling	BD	6	5	Ex..	28
		3D graphics and animation	ATT	3	2	Ex..	
		Web programming / programming technology	BD	6	6	Ex..	
		Multimedia Technology / Multimedia Software	BD	7	5	Ex..	

M.12	Numerical Methods	Discrete mathematics / mathematical statistics	BD	4	5	Ex..	
		Numerical Methods/ Research of optimization methods and operations	BD	6	5	Ex..	10
M.13	data theory	Managing datebases	BD	5	5	Ex..	
		Manufacturing practice	BD	6	2	Ex..	
		Python 3 Programming / Python Programming Basics	BD	6	6	Ex..	
		Object Oriented Programming / Programming with Embarcadero Delphi XE	BD	7	5	Ex..	34
		Information management	ATT	4	5	Ex..	
		Information Systems / Information Systems Theory	KP TS	5	6	Ex..	
		Database programming / PHP programming	BD	7	5	Ex..	
M.14	Programming languages	Theoretical foundations for the development and implementation of programming languages / SQL language	BD	6	6	Ex..	11
		Theory and methods of translation of programming languages / Advanced programming language	BD	7	5	Ex..	
M.15	Information learning methods	Information security software and hardware / Information security	BD	7	5	Ex..	
		Methods of teaching computer science / Methods and technology of teaching computer science	BD	7	5	Ex..	15
		Parallel computing / Parallel programming and multiprocessor computing systems	BD	7	5	Ex..	
M.16	Languages and intelligent systems	Theory of automata and languages / Algorithmic languages and programming	BD	5	5	Ex..	
		Artificial Intelligence System / Artificial Intelligence Theory	BD	7	5	Ex..	10
M.17	Experience	Manufacturing practice	ATT	8	5	Report	8
		Diploma practice	ATT	8	3	Report	
M.18	Final certification	Writing and defending a thesis or preparing and passing a comprehensive exam	FC	8	12	DW	12