ALIKHAN BOKEIKHAN UNIVERSITY

MODULAR EDUCATIONAL PROGRAM

6B06122 "Computer Science"

Semey,2024

Developed by the Department of "Information and Technical Sciences"

Discussed and approved at the meeting of the Department of Information and Technical Sciences
Protocol №6 of February 08, 2024

Reviewed and recommended for re-approval at a meeting of the Academic Quality Council of the Faculty
Protocol №1 of February 21, 2024

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Protocol №5 of May 28, 2024

Content

1. Explanatory note

The modular educational program (MOE) is compiled on the basis of regulatory documents of the Ministry of Education and Science of the Republic of Kazakhstan and internal regulatory documents of Alikhan Bokeikhan University:

- The State standard of higher and Postgraduate education approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2; - Rules for the organization of the educational process on credit technology of education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 №. 152

- Standard rules of activity of organizations of higher and (or) postgraduate education, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595; - Structure of the modular educational program, revision No. 3 of 08.10.2021

- Professional standard "Database Administration", "Software developers and testing specialists, WEB and multimedia applications"approved by the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken", Order №. 171 dated 17.07.2017.

Atlas of new professions "Universal AI Developer".

The MEP is designed 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 GD block (56 academic credits in total) include disciplines common to all educational programs, during the study of which the graduate must master the following competencies: general education.

The BD block includes disciplines of the university component (OC) – 45 academic credits and elective components (EK) - 67 academic credits. Modules of these disciplines form a set of competencies: basic, professional.

The MS block includes disciplines of the university component (OC) - 27 academic credits and elective components (EK) - 37 academic credits. Modules of these disciplines allow you to form a complex of professional competencies acquired by a graduate.

The criterion for completing the educational process is that the student has completed at least 240 credits, including at least 232 academic credits of theoretical training and 8 credits of final certification.The MEP consists of 14 hist modules.

During the development of the modular educational program, the wishes and recommendations of potential employers were taken into account, aimed at the formation of additional professional competencies that meet the requirements of the labor market (round table with employers "Employer - Higher education institution - Future specialist" dated 06.02.2024)

Social partners who took part in the discussion of the MOU:

Khalilov Sh.T. - Technical Director of the iMAS GROUP LLP branch;

Duisenbayeva A.K. – Head of the Competence Center "Radio Engineering, Electronics and Telecommunications" on the basis of the GD East Kazakhstan region "College of Radio Engineering and Communications", head instructor and "Cisco Network Academy";

Kanapin T.K. – Programmer of the Automated Control System Department of Semey Vodokanal;

T. Zhubanov is a Java Developer, medware Atlanta, Georgia.

The purpose of the modular educational program the purpose of the educational program 6B06122 "Informatics" is to train highly professional specialists in the field of programming and design, in the development and implementation of modern information technologies in the field of artificial intelligence, building and improving a database.

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 – description of software components and interfaces between them for later coding and testing. Selection and application of the basic principles of software design.

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

ON 9 – develop and implement AI algorithms to solve practical problems, analyze and optimize the operation of AI algorithms and models.

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 – Demonstrate knowledge of the concept of a modern rule of law state in order to instill skills in financial literacy, entrepreneurship, leadership, and receptivity to innovation based on scientific research while adhering to the principles of academic integrity and ensuring safety standards.

In order to create special conditions for people with special educational needs to receive education, the graduate's competence model is complemented by professional competencies that ensure the adaptive nature of the main educational program. To this end, courses for the formation of the ability of people 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

№	Kompetencies	The list of compulsory, elective disciplines and the sequence of their study		Expected results
		List of disciplines	The sequence of their study (sem.)	
1	Professional competencies	Computer architecture	**1**	**Know**: basic concepts and basic principles of building computer system architectures; types of computer systems and their architectural features; organization and principle of operation of the main logical blocks of computer systems; information processing processes at all levels of computer architectures; main components of computer system software; basic principles of resource management and organization of access to resources. **Must be able to:** develop combinational circuits of various devices; receive information about the parameters of a computer system; connect additional equipment and regulate communications between elements of a computer system; install and configure computer system software. **Skills:** computer work analysis, computer hardware modernization.
		Techics of computer and communication systems		**Know:** about the hardware of computer and communication systems, as well as their technical characteristics and functionality. Perform typical tasks of designing, deploying and maintaining local and global networks. **Must be able to**: apply knowledge and skills in the formulation of applied practical tasks using computer and communication systems technology, establish architectures and key points of distributed client-server applications. **Skills:** identify potential threats and dangers, apply methods and means to ensure the security of software products; use basic tools of computer and communication systems technology.
2		Application packages program	**3**	**Know:** the concept of an application software package; the stages of development of an application software package; the history and stages of the development of printing in Kazakhstan; the concept of office application software packages; the concept of desktop publishing systems; the concept and purpose of technical means of publishing systems; basics of working with the Adobe PageMaker publishing system. **Must be able to:**classify software products depending on their purpose; classify application software packages into types; create texts with publications in Adobe PageMaker; work with objects in Adobe PageMaker; format texts in Adobe PageMaker. **Skills:** creating publications using Microsoft Word software with layout and layout capabilities; creating documents in Microsoft Office Publisher; techniques and methods for creating booklets and layout layouts in Microsoft Office Publisher; working in publishing systems; techniques and working with text, objects in Adobe PageMaker; techniques and creating multi-page publications in Adobe PageMaker.
		Integrated software systems		**Know:** classification of system and application software; theoretical foundations of application software; purpose and capabilities of basic and applied computer software. **Must be able to:** apply application software covering all the capabilities and purpose of the basic and applied computer software. To build software, to program in modern algorithmic languages, to understand the fundamental principles of software construction.

				Skills: setting and solving problems related to the selection of optimal application software, as well as the introduction of professionally-oriented application software in the subject area.
3		Information resources	**4**	**Know**: legal norms of information activity,the state of the world market of information resources, the process of formation of information resources, the structure of information resources, prospects for the development of information resources and information society. **Must be able to:** use personal computers to search and process information, create and process documents; use of computer programs, Internet resources; work with electronic documents. **Skills:** access to electronic information resources, as well as libraries, archives.
		Information resources and technologies		**Know:** the theoretical foundations of the construction and functioning of modern personal computers; types of computer networks; principles of using multimedia; functions and technologies of information and telecommunication services.; **Must be able to:** search for necessary data using query languages and catalogs in various information systems (databases, electronic libraries, websites), organization of access to information resources, organization of work of specialists with information resources: **Skills:** Methods of searching and analyzing information on the Internet; search for information from various sources;
4		Discrete mathematics	**4**	**Know:** basic concepts of sets; algebraic methods for describing models; elementary functions of the algebra of logic, properties and their analytical representation; fundamentals of logical calculus of propositions and predicates; methods for solving classical problems formulated in terms of combinatorics. **Must be able to:** apply combinatorial configurations to solve problems, determine the type of binary relation and its properties, perform operations on sets, represent graphs in various ways, perform operations on graphs, find the shortest path to the graph, build truth tables of Boolean functions, perform identical transformations, find SDNF, SKNF, determine the minimum DNF. **Skills:** using the basic tools of discrete mathematics to solve applied problems; methods of constructing, analyzing and applying discrete models in professional activities.
		Math statistics		**Know:** basic terms, definitions, theorems and concepts of mathematical statistics; **Must be able to:** in accordance with the task set, determine the probabilistic model, the distribution of a random variable, its characteristics, compose and solve various statistical problems. **Skills:** to acquire the skills of formulating and testing statistical hypotheses corresponding to the data of the studied problem.
5		Programming No Code	**5**	**Know:** basic concepts of the theory of formal languages and automata; algorithmic languages; basics of programming **Must be able to**: analyze basic information about tasks requiring the construction of formal languages, record formal definitions of such languages, build and analyze algorithmic tools for analyzing such languages; program in various algorithmic languages. **Skills:** solving problems encountered in the design and implementation of software projects aimed at building compilers and other means of processing formal languages.
		Low Code Development		**Know:** algorithmic methods; features of the structure, organization and practical implementation of algorithms; know the basics and prospects for the development of new technologies **Must be able to:**To consider the properties of algorithms and situations in which these algorithms can be useful; to create various programs using fundamental computational algorithms and their properties, leading to linear, branching

				and cyclic type of algorithms; to process arrays using various internal sorting methods; to investigate the relationship with the analysis of algorithms; to analyze the effectiveness of algorithms; to practically use the construction of models and data structures, conduct subsequent analysis of the results obtained. Skills: development of algorithms and programs for solving problems; practical work on the use of modern software, modern computer technology
6		SOFTWARE development Basics Computer Software	**5**	**Know:** Visual programming systems. Fundamentals of management theory. **Must be able to:** Methods and means of protecting computer information. **Skills:**Neurocomputer systems. ARM and CAD. Interactive graphics systems. Artificial intelligence systems. Programming on the Internet
				Know: Computer hardware. **Must be able to:** Computerization software **Skills:**system, service and application software.
7		Robotics and the basics of artificial intelligence Robotic systems and complexes	**5**	**Know:** analyze and evaluate mathematical models of robotic systems and automation of production processes using modern data software products; development of algorithms aimed at the structure. **Must be able to:** design automation and robotics systems; compare with the use of modern software products for the robotization of technological complexes and automation systems of production processes in various industries, as well as artificial intelligence methods.; **Skills:** formation of modern trends in the development of automation systems of production processes and robotics
				Know: standards, methodological and regulatory materials accompanying the operation, installation, commissioning and design of robotic technological complexes in various industries. **Must be able to:** develop mathematical models of production process robotization systems using modern software products. Skills: organization of work on the development, commissioning, installation and operation of means and systems of robotization of production processes.
8		Informational systems Information protection in information systems	**5**	**Know:** the composition and structure of information systems, technical and software tools and to have an idea of the structure of the information process, to know the basics of the organization of information processes; **Must be able to**: use system analysis in the formulation and algorithmization of information system tasks, determine the conceptual model of information systems; **Skills**: system analysis in the formulation and formalization of information system tasks, definition of the conceptual model of information systems.
				Know: the basics of the organization of information processes; to 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; **Must be able to:** apply basic models and means of information transmission to optimize modern computer systems. **Skills:** understanding of the basic concepts of information theory: classification and measurement of information, transmission rates and mathematical models of signals
9		Computing modelling	**6**	**Know:** typical classes of models and methods of 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; **Must be able to:** apply a systematic approach to the research, design and operation of information systems, develop modeling algorithms and implement them using algorithmic languages and modeling application software packages, automate the design process using modeling databases.

		Mathematical and computer modeling		**Skills:** using computer modeling tools to create psychological comfort of the user
				Know: methods of solving basic mathematical problems – integration, differentiation, solving linear and transcendental equations and systems of equations using computers; basic principles of constructing mathematical models; basic types of mathematical models. **Must be able to:** develop algorithms and programs for solving computational problems, taking into account the necessary accuracy of the result; select analytical methods for the study of mathematical models; use numerical methods for the study of mathematical models. **Skills:** solve computational problems using computer modeling.
10		Programming in Python 3	**6**	**Know:** Programming language.NumPy.SciPy. Basic knowledge of computer science. Organization of operating system procedures. Development of programs of complex structure. **Must be able to**:I/O software. **Skills:** Microprocessor computer software. Basics of working with the operating system. Matplotlib .C++ Boost.Java. System programming.
		Data analysis and machine learning		**Know:** The formation of skills in the Python programming system. **Must be able to:**The study of programming algorithmization in the development of thinking .ICT at a professional level.Modeling as a tool of cognition.Machine learning, data analysis and visualization. **Skills:**Mapping different URLs to parts of Python code, working with databases, creating HTML views for display on user devices.
11		Numeral methods	**6**	**Know:**fundamentals of error theory and approximation theory; basic numerical methods of algebra; methods of constructing elements of the best approximation; methods of constructing interpolation polynomials; methods of numerical differentiation and integration; methods of numerical solution of ordinary differential equations; methods of numerical solution of partial differential equations; **Must be able to:** numerically solve algebraic and transcendental equations using the consequences of the theorem on compressive maps; **Skills:** practical assessment of the accuracy of the results obtained in the course of solving certain computational problems, based on the theory of approximations; technologies for applying computational methods to solve specific problems from various fields of mathematics and its applications.
		Methods of optimization and research operations		**Know:**the use of modern optimization algorithms, their software implementation on computers and practical application in methods of analysis and optimal parametric synthesis of control systems. **Must be able to:** use diagnostic methodology for optimal results in solving optimization problems, optimization methods that allow you to build mathematical models of operations research in applied problems. using optimization methods, analyze the results of calculations and substantiate the conclusions. **Skills:** apply practically acquired knowledge and use the studied software packages to solve specific optimal control problems, use optimization methods in the study, modeling of problems, skills in analyzing and processing the necessary data for mathematical formulation.
12		Web development Programming technology	**6**	**Know:** hypertext markup language HTML; basics of working with web page creation programs Programming languages JavaScript, VRML **Must be able to:** plan the amount of work when developing a Web page; develop the structure and design of a Web page; create Web pages in JavaScript programming languages; publish pages on the global Internet. **Skills:** working with tools for developing and debugging client and server parts of Internet applications.
				Know: programming languages and technology

				Must be able to: plan and organize a scientific, creative approach to the development of technologies, methods and means of programming **Skills:** As a result of studying the discipline, the student must acquire the skills of compiling, debugging and testing programs, as well as developing and using interface objects.
13		The theoretical basis for the development and implementation of programming languages	**6**	**Know:** basic logical methods and techniques of scientific research, methodological theories and principles of modern science; - mathematical apparatus describing the interaction of information processes and technologies at the information, software and technical levels, the theory of neural networks and the principles of use in the design of information systems;- concepts, principles, methods of implementation of programming languages; **Must be able to:** carry out methodological substantiation of scientific research; apply modern methods of scientific research to form judgments and conclusions on the problems of information technologies and systems; carry out mathematical formulation of the tasks under study, apply the apparatus of neural networks in the field of information technology ; to analyze scientific results in the field of theoretical foundations of programming languages; independently carry out scientific research in the field of modern theory of programming languages; **Skills:** logical and methodological analysis of scientific research and its results;- methods of scientific search and intellectual analysis of scientific information in solving new problems.
		SQL language		**Know**: the main provisions of the theory of databases, data warehouses, knowledge bases; the basic principles of building a conceptual, logical and physical data model; modern tools for developing a database schema; **Must be able to:** create database objects in modern database management systems and manage access to these objects; work with modern database design Case tools; form and configure a database schema; develop application programs using the SQL language; **Skills:** working with database objects in a specific database management system; using database filling tools; using standard methods for protecting database objects.
14		Object Oriented Programming	**7**	**Know:** what is an object and a class, the basic principles of object-oriented programming, the principles of class construction, the criteria for verifying the correctness of class formation, the main trends in the development of object-oriented programming technologies. **Must be able to:** apply modern methods of object-oriented programming when coding software systems of various levels. **Skills:** working with visual programming environment C++ Builder.
		Programming in Embarcadero Delphi XE development environment		**Know:** SQL Server, Oracle, Multi-Device, SQLite, 3D Graphics, Float and Path animation. **Must be able to:** compose cyclograms from methods in Delphi applications. **Skills:** advanced code formatting settings.
15		Hardware and software protection of information	**7**	**Know:** basic concepts and directions in the protection of computer information, principles of information protection, principles of classification and examples of security threats to computer systems; methods for evaluating the results of the application of organizational and technical solutions to ensure information security. **Must be able to:** configure the built-in security tools in the operating system, analyze the security of the computer and the network environment using a security scanner; install and use one of the means for encrypting information and organizing data exchange using an electronic digital

		Information security		signature; evaluate the effectiveness of the hardware and software used to ensure information security **Skills:** information systems security audit, methods of system analysis of information systems; control of the implementation of plans for technical counteraction to threats to the organization's information.
				Know: the methodology for analyzing the effectiveness of the functioning of the SPI; the basic concepts, goals and objectives of the ZI at the enterprise; the essence and components of the ZI; the principles of the organization and stages of the development of the ZI; factors affecting the organization of the WINTER **Must be able to:** analyze the effectiveness of the functioning of the SPI; use the principles of organization and stages of development of the SPI; identify factors affecting the organization of the WINTER **Skills:** security audit of information systems, methods of system analysis of information systems.
16		Programming No Code	**7**	**Know:** the main content of the course has been mastered, allowing to assess the time and capacity complexity of software, but there are difficulties or inaccuracies in the presentation, which the student corrects with leading questions from the teacher; the main content of the course has been mastered, allowing to assess the time and capacity complexity of software, but there are difficulties or inaccuracies in the presentation, which the student corrects independently the content has been mastered, allowing to assess the time and capacity complexity of software, the presentation is clear and competent, without difficulties and inaccuracies **Be able to:** perform all operations that allow to assess the time and capacity complexity of software, but makes mistakes, which he cannot always correct without leading questions from the teacher performs all operations that allow to assess the time and capacity complexity of software, but makes inaccuracies, which he can correct without leading questions from the teacher performs all operations that allow to assess the time and capacity complexity of software; actions are well thought out and free of errors **Skills:** demonstrates uncertain mastery of the required skills, existing experience is fragmented, but sufficient to complete the task demonstrates mastery of the required skills, existing experience is sufficient to complete the task demonstrates confident mastery of the required skills, the task is solved quickly and in the best possible way
		Low Code Development		**Know:** the basics of UI/UX design, testing and business analytics. Learn popular No-code platforms (for example, Bubble, Creatio and Webflow). **Be able to:** use prototyping software. Write technical tasks and work with tables. Follow trends in your field. **Skills:** Understand business processes. Understand mailing services, databases, payment systems and other useful things.
17		Parallel computing	**7**	**Know:** basic models of parallel computers; fundamentals of parallel data processing; **Must be able to:** program and create software products using parallel algorithms in programming languages that support parallelization, as well as using MPI, OpenMP, DVM technologies **Skills:** building parallel analogs of computational algorithms.

		Multiprocessor computer systems and parallel programming		**Know:** an efficient parallel computing algorithm for solving applied problems. **Be able to:** reasonably apply computer technology in automation systems; **Skills:** choosing the optimal network technology for information support of control systems.
18		Graphic and multimedia design	**7**	**Know:** basic methodological skills of multimedia systems; multimedia implementation technology; drawing modeling technology; **Must be able to:** design multimedia systems; develop a modular project structure; use built-in language capabilities design multimedia systems create multimedia applications **Skills:** to develop skills in multimedia programs and tools.
		Multimedia software		**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; **Must be able to:** input, store, process, transmit and publish digital information, including sound, images, video and multimedia products on a personal computer and global computer networks; save a ready-made multimedia product on modern storage devices. **Skills:** programming in the Flash Professional environment. methods and means of creating modern multimedia products.
19		Database programming	**7**	**Know:** the basic concepts of building database models, methods and tools for designing relational databases, features of programming for interacting with databases, DBMS organization, methods of data protection by DBMS, the basics of access rights differentiation, the basics of the SQL language for working with data organized in the form of a relational database; **Must be able to:** program databases in various programming environments; **Skills:**development of software databases designed to solve economic and scientific and technical problems.
		Programming in PHP		**Know:**PHP programming language, development of web application design and programming skills **Must be able to:** use the PHP programming language to develop web applications. The PHP language was created to solve a specific practical problem in the Internet environment. **Skills:** designing web applications using theoretical and practical skills in the PHP programming environment
20		Java programming Technology	**8**	**Know:** Understanding of basic Java syntax, including variable declarations, operators, loops, conditionals, and handling I/O streams. Understanding of basic data structures, such as lists. **Be able to:** Students should be able to solve problems and find solutions using Java and related algorithms and data structures. Ability to create architecturally balanced applications following OOP principles and using appropriate design patterns. Ability to identify and fix errors in code using a debugger and logging. **Skills:** Ability to write tests to verify the correctness of the code and ensure its reliability. Willingness to independently study new technologies, frameworks, and tools related to Java development. Understanding and adhering to Java coding standards to improve the readability and maintainability of code. Ability to tailor development to specific project requirements and manage a project, following deadlines and budget.
		Programming languages		**Know:** basic syntax of programming languages: Python 3, Ruby, Perl, Go and their capabilities; principles of forming readable code; Top-down and bottom-up software development techniques; the ideology of the modular and object-oriented approach; typical solutions used to create programs; **Be able to:** develop readable programs; use both built-in and online library documentation; connect additional modules

				and standard modules and packages; apply an object-oriented approach to writing programs; develop programs both individually and in a team, using modern tools for writing and debugging programs. **Skills:** using integrated development environments (IDE) for writing programs; using an interactive console for interpreted programming languages; basic commands of the git version control system; debugging and introspection of someone else's program code.

Table 2. Sequence of mastering disciplines of social and professional interaction.

Course	Disciplines that provide	Competencies	Expected result
1	History of Kazakhstan	Socio-ethical competencies	**Know:** demonstrate knowledge and understanding of the main stages of development of the history of Kazakhstan; **Be able to:** correlate the phenomena and events of the historical past with the general paradigm of the world-historical development of human society through critical analysis; be able to objectively and comprehensively comprehend the inherent features of the modern Kazakhstani development model; **To master**:possess the skills of analytical and axiological analysis in the study of historical processes and phenomena of modern Kazakhstan; systematize and give a critical assessment of historical phenomena and processes of the history of Kazakhstan
1	Information and Communication Technologies	Socio-ethical competencies	**To know:** what economic and political factors contributed to the development of information and communication technologies; - features of various operating systems, architecture. **Be able to:** identify the main trends in the field of information and communication technologies; - use information resources to search and store information; - work with spreadsheets, consolidate data, build graphs; - apply methods and means of information protection; design and create simple websites; - process vector and raster images; create multimedia presentations; use various platforms for communication; - calculate and evaluate performance indicators of supercomputers; - use various forms of e-learning to expand professional knowledge; - use various cloud services. **To master:** possess the skills of: - 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	Foreign language	Socio-ethical competencies	**To know:** the lexical minimum and the language material of topics and subtopics in this discipline (socio-household and socio-cultural spheres of communication). **Be able to:** understand by ear not only individual phrases and frequently used words, but also more voluminous statements on topics directly related to him, understand the main content of short simple communications on the radio, at the airport, at the train station. understand when reading the content of short, simple texts, advertisements, brochures, menus, bus and train schedules, a short, simple personal letter, an electronic message. communicate in simple typical situations that require the exchange of information within familiar topics and activities, be able to talk about family, living conditions, educational classes. write a simple personal letter, a note, an autobiography. **To master**: understanding of foreign-language dialogic and monological speech within the framework of general cultural and professional topics; foreign language at the level that allows you to carry out the main types of speech activity; various ways of oral and written communication; skills of adequate response in situations of everyday, academic and professional communication; listening, reading, writing skills.
1	Kazakh (Russian) language	Socio-ethical competencies	**To know:** the theoretical foundations of the course (language, its functions, forms of speech, text, its signs, speech styles, functional and semantic types of speech); features of dialogic and monological speech; types of scientific information and the specifics of its implementation in a scientific text; elements of structural and

			semantic analysis and semantic analysis of scientific text, components of the speech situation, the speaker's intentions. **Be able to:**to make the right choice and use of language and speech means to solve certain problems of communication and cognition based on knowledge of a sufficient volume of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions; to compose everyday, socio-cultural, official and business texts in accordance with generally accepted norms, functional orientation, using lexico-grammatical and pragmatic material of a certain certification level adequate to the goal; to convey the factual content of texts, formulate their conceptual information, describe the deductive knowledge (pragmatic focus) of both the entire text and its individual structural elements. elements; interpret the information of the text, explain the stylistic and genre specifics of the texts of socio-cultural, socio-political, official-business and professional spheres of communication in the scope of certification requirements; to participate in communication in various situations of different spheres of communication in order to realize one's own intentions and needs (domestic, educational, social, cultural), stating them ethically correctly, meaningfully fully, lexically-grammatically and pragmatically adequate to the situation; discuss ethical, cultural, socially significant issues in discussions, express your point of view, defend it in a reasoned manner, critically evaluate the opinion of interlocutors; to build programs of speech behavior in situations of personal, social and professional communication in accordance with the norms of language, culture, specifics of the sphere of communication, certification requirements; to request and report information in accordance with the communication situation, evaluate the actions and actions of participants, use information as a tool to influence the interlocutor in situations of cognition and communication in accordance with certification requirements. **To master:** the skills of producing oral and written speech in accordance with the communicative purpose and professional sphere of communication; language skills in various situations of everyday, socio-cultural, professional communication; skills of searching, processing information in Russian; types of speech activity.
2	Philosophy	Socio-ethical competencies	**To know:** the basic philosophical concepts and categories, the laws of the development of nature, society and thinking; the essence of philosophical categories, the terminology of philosophy and the structure of philosophical knowledge, the functions of philosophy, methods of philosophical research; the place and role of philosophy in public life; **Be able to:** use the basics of philosophical knowledge to form a worldview position; analyze worldview, socially and personally significant philosophical problems; to orient oneself in the system of philosophical knowledge as a holistic view of the foundations of the universe and the prospects for the development of planetary society; to understand the characteristic features of the modern stage of the development of philosophy **To master:** the skills of philosophical analysis of various types of worldview; the skills of philosophical thinking to develop a systematic, holistic view of the problems of society;
1	Political Science	Socio-ethical competencies	**To know:** the main content of the course "political science"; * mastering the 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 ideological problems and solve them; - think logically, systematically and critically; - to use the baggage of philosophical erudition acquired for the formation and argumentation of their own judgments on various everyday issues. **To master:** general education.

	Sociology		**To know:** the patterns and stages of the historical process, the main historical facts, dates, events and names of world and domestic historical figures; - the main events and processes of national history in the context of world history **Be able to:** - critically perceive, analyze and evaluate historical information, factors and mechanisms of historical changes; - analyze civil and ideological positions in society, form and improve their views and beliefs, transfer philosophical worldview to the field of material and practical activities; - use various philosophical methods to analyze trends in the development of modern society, philosophical and legal analysis **To master:** - the skills of a holistic approach to the analysis of society's problems; - methods of philosophical, historical and cultural studies, techniques and methods of analyzing the problems of society; - causal relationships in the development of Kazakhstan society; the place of a person in the historical process and the political organization of society; skills of respectful and careful attitude to the historical heritage
	Culturology		**To 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 **To master:**practical skill of using knowledge in the analysis of specific social situations.
	Psychology		**To know:** the meaning and place of psychology in the system of sciences; the main directions of personality development in modern psychology; personal values and meanings in professional self-determination; the relationship and mutual influence of the psyche and body; techniques and techniques of effective communication. **Be able to**: interpret basic psychological theories, concepts; use methods and mechanisms of emotion regulation in everyday life; identify patterns of behavior in a conflict situation and conduct self-diagnosis. **To master:** definitions of individual psychological characteristics of personality, value-semantic representations in professional self-determination of personality; recognition of psychological impact and effective communication.
1	Basis of market economy and entrepreneurship	Socio-ethical competencies	**To know:** methods of scientific research in economics,various theories about entrepreneurship, financial literacy and market economy, types of entrepreneurial activity, spheres of entrepreneurship, to master various quantitative and qualitative methods for creating the future of your own business, entrepreneurial calculations, analytical calculations and forecasts, the main provisions of the Constitution and the current legislation of the Republic of Kazakhstan, the system of public administration bodies and their terms of reference, the mechanism of interaction of substantive and procedural law, the essence of corruption and the reasons for its origin, current legislation in the field of anti-corruption. **Be able to:** analyze and justify the reality of business plans, market segmentation, competently and professionally assess the market situation for the organization of their business, creatively approach the solution of various economic tasks, possess practical skills of independent economic work in the field of entrepreneurship, calculate your personal budget, have clear background information and fast and correct orientation to economic indicators, analyze events and actions from the point of view of the field of legal regulation and be able to refer to the necessary regulations, navigate the current legislation, using the law to

			protect their rights and interests, to use spiritual and moral mechanisms to prevent corruption. **To master:**: acquire practical skills in building graphs and diagrams illustrating various economic models, independent economic work in the field of entrepreneurship, quickly and correctly navigate the actual source information and estimated economic indicators, determine the levels of financial security, have the skills to identify problems of an economic nature in the analysis of specific situations and their solutions, taking into account the actions of economic patterns at the micro and macro levels, conducting discussions on legal issues, on the application of norms in the modern period, analysis of the situation of conflict of interests and moral choice.
1	Basis of scientific and ecological thinking	Socio-ethical competencies	**To know:**forms and methods of pre-scientific, scientific and extra-scientific cognition, modern approaches to socio-humanitarian knowledge and their commensurability; basic epistemological models, the nature of transformations of the concept of rationality; fundamentals of ecology and safe human activity in the habitat, environmental factors and their impact on living organisms, methods for identifying, eliminating the influence of harmful factors on the person and the environment, and providing comfortable conditions for human life and activity; **be able to:** formulate and solve problems that arise in the course of research and require in-depth professional knowledge; modify existing and develop new methods based on the tasks of a specific study; choose methods of protection from hazards in relation to the field of their professional activities and choose ways to ensure comfortable living conditions; **To master:**: conducting independent research and scientific and pedagogical activities that require extensive education in the appropriate direction; the ability to apply methodological and methodological knowledge in conducting scientific research; skills to ensure the safety of life in professional activities, living conditions and in emergency situations.
2	Professional Kazakh (Russian)language	Basic competence	**To know:** professional vocabulary and terminology; specifics of oral communication in the professional sphere; language features of oral and written communication; features of business communication and business etiquette. **Be able to**: use the Russian language in interpersonal communication and professional activity; carry out business communication and conduct business conversations on professional topics; write and transmit the necessary information; explain your point of view and critically evaluate the propositions put forward; create your own statements, essays, etc. apply business etiquette norms in speech **To master:** the skills of expressing their thoughts and opinions in interpersonal business communication in Russian; professional terms and concepts;
2	Professionally-oriented foreign language	Basic competence	**To know :** the lexical material on the topics of this discipline; regulatory requirements for registration (official letter, essay, etc.). improve pronunciation skills; develop productive and receptive lexical and grammatical skills; improve general dialogical speech skills related to everyday and professional communication situations; develop listening skills (with a full understanding of what was heard); to develop and improve writing skills; to improve the skills of introductory, studying, viewing and searching reading. **Be able to:**to automate the technical skills of reading to oneself; to develop the ability to transmit scientific information and literature of a socio-political nature; to develop the skills of monologue (prepared) speech – the deployment of a thesis; to master the reversed reading aloud of a prepared message; to teach the skills of abstracting. **To master:** the complexity in solving practical, educational, educational and developmental goals (with practical goals acting as the leading ones);

			the communicative orientation of the learning process.
1	Mathematics 1.2	Basic competence	**To 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; - examine the sequence for similarity; - investigate the presence of a limit at a point, continuity at a point and a set; - investigate the function using the derivative and plot the function, apply various integration methods, apply certain integrals; - to study and calculate integrals of the first and second kind.; **To master:** 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	Basic competence	**Know:** algorithmic methods of algorithms; structural features, 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 linear, branched and cyclic type of algorithms; process arrays using various internal sorting methods; investigate related to the analysis of algorithms; analyze the effectiveness of algorithms; practice building models and data structures, conduct subsequent analysis of the results obtained. To master: development of algorithms and programs for solving problems; practical work on the use of modern software, modern computer technology;
2	Programming languages and technologies	Basic competence	**To know:** the basic elements of a programming language: data types, operators; the possibilities of library functions, abstract and user types, structures, functions, etc.; trends in the development of programming languages and the scope of application; software development tools; ergonomic, aesthetic, psychological requirements for software; methods of structural analysis. **Be able to:** carry out system analysis, design, coding, configuration and testing, consolidation and output of a software product; conduct primary analysis and evaluate the results of identified limitations; look for critical points of view of the project **To master:** basics of automation of problem solving, skills of working with modern programming languages and their tools and capabilities of the integrated processing environment.
2	Operating systems	Basic competence	**To know:** fundamental principles of operating system design; purpose, functions, classification of operating systems; principles of computer resource management; the concept of multiprogramming, processes and flows; principles of virtualization and mobility of operating systems. **Be able to:**implement basic algorithms for planning and synchronizing processes and threads, memory management, disk planning; develop multithreaded applications; take into account the specifics of working in a particular operating system; use the tools of operating systems. **To master:**installation of operating systems, account management, setting up the parameters of the user's working environment, connecting and configuring hardware devices, Managing disks and files with systems, configuring network settings.

3	Computer networks	Basic competence	**To know:** assessment and control of LAN performance; computer, server equipment and peripherals, types of their compatibility, technical characteristics; resource management; calculation of costs for LAN design and installation. **Be able to:** organize software version updates develop LAN maintenance organization regulations; monitor software version updates; make a plan for preventive software work. **To master:** possess: network construction methods; current protocols and their features; skills about network optimization methods
3	Managing datebases	Basic competence	**To know:** principles of organization of modern databases and database systems; basic 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 related to it; organize the processing of information in the database; organize the integrity of the database. **To master:** work in a special database management system, training in the creation of basic objects in the database; distribution of basic functions, the need to release the task; creation of applications in the database.
1	Computer architecture	Basic competence	**To know:** basic concepts and basic principles of building computer system architectures; types of computer systems and their architectural features; organization and principle of operation of the main logical blocks of computer systems; information processing processes at all levels of computer architectures; the main components of computer system software; basic principles of resource management and organization of access to these resources. **Be able to:** develop combinational circuits of various devices; receive information about the parameters of a computer system; connect additional equipment and configure communication between elements of a computer system; install and configure computer system software. Installation and configuration of computer systems software. **To master:** analysis of computer operation, modernization of computer hardware.
	Techics of computer and communication systems		**To know:** hardware and software tools for functional control and diagnostics of computer systems and complexes possibilities and applications of standard and special control and measuring equipment for localization of fault locations of SVT. **Be able to:** monitor, diagnose and restore the operability of computer and communication systems, perform typical tasks of designing, deploying and maintaining local and global networks; administer networks in modern operating systems; **To master:** system maintenance of computer and communication systems, to apply technologies of network interaction of communication systems.
2	Application packages program	Basic competence	**To know:** the concept of an application software package; the stages of application software package development; the concept of office application software packages; the concept of desktop printing systems; the concept and purpose of printing system hardware; 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 AdobePageMaker; work with adobepagemaker objects; format adobepagemaker texts. **To master:** creating publications using MicrosoftWord software with layout and layout capabilities; creating documents in Microsoft Office Publisher; creating booklets and layout layouts in Microsofficepublisher; working in print systems; working with objects, text and techniques in AdobePageMaker; creating and receiving multi-page publications in AdobePageMaker.

	Integrated software systems		**Know:** basic syntax of programming languages: Python 3, Ruby, Perl, Go and their capabilities; principles of forming readable code; Top-down and bottom-up software development techniques; the ideology of the modular and object-oriented approach; typical solutions used to create programs; **Be able to:** develop readable programs; use both built-in and online library documentation; connect additional modules and standard modules and packages; apply an object-oriented approach to writing programs; develop programs both individually and in a team, using modern tools for writing and debugging programs. **Skills:** using integrated development environments (IDE) for writing programs; using an interactive console for interpreted programming languages; basic commands of the git version control system; debugging and introspection of someone else's program code.
2	Information resources	Basic competence	**To know**: the principles of working 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; **To master:** working with browsers; search and analysis of information resources; methods and techniques for creating hypertext documents; methods of searching and analyzing information on the Internet; working with modern information resources.
	Information resources and technologies		**To know:** ways of using Internet information and communication services; 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 the use of information resources: **To master:** methods of searching and analyzing information on the Internet; searching for information from various sources; analyzing relevant information, clarifying demand in order to improve search efficiency; working with modern information resources.
2	Discrete mathematics	Basic competence	**To know:** algebraic methods for describing models.; simplest functions, properties of the algebra of logic and their analytical expression; fundamentals 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 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 the bul function, perform similar transformations, find SDNF, SKNF, determine the minimum DNF. **To master:** the use of basic means of discrete mathematics for solving applied problems; methods of construction, analysis and application of discrete models in professional activity.
	Math statistics		**To know:**patterns in random and information processes (type of distribution, numerical characteristics, accumulation, processing, distribution, etc.). **Be able to:**create mathematical and computer models of random phenomena in various fields of human activity. **To master:**information about the main scientific achievements in probability theory and mathematical statistics.
3	Theory of languages and automata	Basic competence	**To know:** basic concepts of formal languages and automata theory; algorithmic languages; programming basics **Be able to:** analyze basic information about tasks requiring the creation of formal languages, write formal definitions of such languages, create and analyze tools for algorithmic analysis of such languages; program in various algorithmic languages.

			To master: solving problems arising in the design and implementation of software projects aimed at creating compilers and other means of processing formal languages.
	Algorithmic languages and programming		**To 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 linear, branched and cyclic type of algorithms; process arrays using various internal sorting methods; investigate related to the analysis of algorithms; analyze the effectiveness of algorithms; apply on practice building models and data structures, conduct subsequent analysis of the results obtained. **To master:** development of algorithms and programs for solving problems; practical work on the use of modern software, modern computer technology
3	SOFTWARE development basics	Basic competence	**To 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 andtrends in the development of the software market **To master:** work with automated software development tools, support for collective software development.
	Computer Software		**To know:** the main types of software and their purpose; ways to configure the software; **Be able to:** perform project work using the most common software packages; **To master:** the skills of working with software and using software tools to solve applied problems.
3	Robotics and the basics of artificial intelligence	Basic competence	**To know:** mathematical models of robotic systems and automation of production processes using modern data software products; development of algorithms aimed at the structure. **Be able to:** design automation and robotics systems; compare with the use of modern software products for the robotization of technological complexes and automation systems of production processes in various industries, as well as artificial intelligence methods.; **To master:** formation of modern trends in the development of automation systems of production processes and robotics
	Robotic systems and complexes		**To know:** methods of building robotic complexes or automated control systems for technological processes and technical systems in various industries;; **Be able to:** develop and research mathematical models of automation systems or robotization of production processes using modern software products; **To master:** current trends in the development of technical means and systems of automation or robotization of production processes;
3	Computing modelling	Basic competence	**To know:** model classes of models and methods of modeling complex systems, the apparatus of the Monte Carlo method, principles of constructing models of the processes of functioning of complex systems, methods of formalization and algorithmization; **Be able to:** apply a systematic approach to the study, design and operation of information systems, develop modeling algorithms and implement them using algorithmic languages and modeling application software packages, automate the design process using modeling databases. **To master:** the use of computer modeling tools to create psychological comfort of the user.
			To know: methods of solving basic mathematical problems-integration, - differentiation, solving systems of equations using linear and transcendental equations and computers; basic principles of constructing mathematical

	Mathematical and computer modeling		models; basic types of mathematical models. **Be able to:** develop algorithms and programs for solving computational problems, taking into account the necessary accuracy of the result; choose analytical methods for studying mathematical models; apply numerical methods for studying mathematical models. **To master:** solve computational problems using computer modeling.
3	Programming in Python 3 Data analysis and machine learning	Basic competence	**To know:** paradigms, architectural features, semantics and syntax of the Python programming language, purpose, structure and properties of the basic 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. **To master:** skills of reading, writing, debugging and testing programs in a high-level programming language in an integrated design environment.
			Know: Basic knowledge of syntax, including coding conventions (PEP 8). Understand the different data types in Python, such as numbers, strings, lists, tuples, dictionaries, and sets. **Be able to:** Define and use functions in Python, including argument passing, return values, and variable scope. **Skills**: Understanding the basic concepts of OOP in Python, such as classes, objects, inheritance, encapsulation, and polymorphism. Solve problems and write simple programs to reinforce what you've learned.
3	Numeral methods Metfods of optimization and research operations	Basic competence	**To know:** fundamentals of error theory and approximation theory; basic numerical methods of algebra; methods of constructing elements of the best approximation; methods of 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 numerically, using for this is a consequence of the compression image theorem.; **To master:** practical evaluation 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 fields of mathematics and its applications.
			To know: the basics of the theory of operations research, vector programming, game theory and the basic principles of optimality, to model practical tasks of operations research and apply mathematical apparatus in solving them on a computer. **Be able to:** simulate practical tasks of operations research and apply mathematical apparatus when solving them on a computer. **To master:** theoretical knowledge of the theory of operations research and skills of applying mathematical modeling in solving problems of the theory of operations research.
4	Object Oriented Programming Programming in Embarcadero	Basic competence	**To know:** what is an object and a class, the basic principles of object-oriented programming, the principles of class construction, the criteria for verifying the correctness of class construction, 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. **To master:** working with the visual programming environment C++ Builder.

	Delphi XE development environment		**To know:** basic principles of object-oriented programming, principles of class construction, 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. **To master:** Advanced code formatting settings.
4	Hardware and software protection of information	Basic competence	**To 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 computer systems; methodology for evaluating the results of the application of 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; evaluation of the effectiveness of the hardware and software used to ensure information security. **To master:** information systems security audit, methods of system analysis of information systems; control over the implementation of plans for technical counteraction to threats to the organization's information.
	Information security		**To know:** the basics of information security and information protection, the principles of cryptographic transformations, standard software and hardware and information protection systems from unauthorized access to the computer environment; **Be able to:** methods and means of database design, features of database administration in local and global networks. Types of threats to information systems and methods of ensuring information security. **To master:** the use of functional and technological standards in information systems. Working with database and knowledge design tools and information protection;
4	Java programming Technology	Basic competence	**To know:**Understanding of basic Java syntax, including variable declarations, operators, loops, conditionals, and handling I/O streams. Understanding of basic data structures, such as lists. **Be able to:** Students should be able to solve problems and find solutions using Java and related algorithms and data structures. Ability to create architecturally balanced applications following OOP principles and using appropriate design patterns. Ability to identify and fix errors in code using a debugger and logging. **Skills:** Ability to write tests to verify the correctness of the code and ensure its reliability. Willingness to independently study new technologies, frameworks, and tools related to Java development. Understanding and adhering to Java coding standards to improve the readability and maintainability of code. Ability to tailor development to specific project requirements and manage a project, following deadlines and budget.
	Programming languages		**To know:**basic syntax of programming languages: Python 3, Ruby, Perl, Go and their capabilities; principles of forming readable code; Top-down and bottom-up software development techniques; the ideology of the modular and object-oriented approach; typical solutions used to create programs; **Be able to**: develop readable programs; use both built-in and online library documentation; connect additional modules and standard modules and packages; apply an object-oriented approach to writing programs; develop programs both individually and in a team, using modern tools for writing and debugging programs. **Skills:** using integrated development environments (IDE) for writing programs; using an interactive console for interpreted programming languages; basic commands of the git version control system; debugging and introspection of someone else's program code.

2	3D graphics and animation	Professional competencies	**To 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. **Be able to:** use basic visual techniques and materials; use computer graphics tools in the process of design design. **To master:** working with raster, two-dimensional and three-dimensional vector graphics software; basic functionality of modern graphics systems; organization of dialogue in graphics systems.
2	Information management	Professional competencies	**To know:** about risks; subject and information technologies; information systems, decision-making process, functional IT, IT structure; the place of IP in a manufacturing enterprise, functional sections of IP; **Be able to:** assess the expected risks of acquiring IP, implement IP and use IP; analyze the management system for subsequent automation; **To master:** the definition of information management tasks and methods of their solution.
4	Artificial intelligence technology	Professional competencies	**To know:** Basic concepts and terminology in the field of artificial intelligence (AI). Classification and main types of AI technologies (machine learning, deep learning, natural language processing, etc.). Principles of operation of AI algorithms and their application in various fields. Main Python libraries for developing AI applications (e.g. TensorFlow, Keras, PyTorch, scikit-learn). Ethical and legal aspects of using AI technologies. **Be able to:** Develop simple machine learning models using Python. Perform data analysis and preprocessing of data for use in AI models. Evaluate the quality of models and select appropriate metrics to evaluate their effectiveness. Implement basic deep learning algorithms. Apply natural language processing methods to solve problems such as text classification and sentiment analysis. **To master:** Ability to work with Python libraries for developing AI-based applications.Practical skills in developing and testing AI models.Ability to analyze and interpret the results of models.Skills in working in a team and participating in project activities related to the development of AI solutions.Ability to independently search for and apply relevant information on the latest achievements in the field of AI
Optional components			
3	Information systems	Professional competencies	**To know:** the composition and structure of information systems, technical and software tools and an idea of the structure of the information process, to know the basics of the organization of information processes; **Be able to:** apply system analysis in the formulation and algorithmization of information system tasks, determine the conceptual model of information systems.; **To master:** system analysis in the formulation and formalization of information system tasks, definition of the conceptual model of information systems.
	Information protection in information systems		**To know:**Know: Basic concepts and principles of information security. Methodologies and technologies for protecting information systems. Methods for correcting and restoring information characteristics. Basics of working with data privacy systems. **Be able to:** Analyze risks and vulnerabilities of information systems. Develop and implement measures to protect information. Apply methods for restoring and correcting information. Assess the level of confidentiality of information in databases.

			Skills: Use tools and technologies to protect information. Conduct an audit of security systems. Monitor and manage the security of information systems. Create and implement security policies in the organization.
3	Web development	Professional competencies	**To know:** hypertext markup language HTML; basics of working with web page creation programs programming languages Java Script, VRML **Be able to:** plan the amount of work when developing a Web page; develop the structure and design of a Web page; create Web pages in the JavaScript programming language; publish pages on the global Internet. **To master:** working with tools for processing and debugging the client and server parts of Internet applications.
	Programming technology		To know: programming languages and technologies Be able to: plan and organize a scientific, creative approach to the development of tools and methods, programming technologies aster: as a result of studying the discipline, the student must To master the skills of compiling, configuring and testing the program, as well as developing and operating interface objects.
3	The theoretical basis for the development and implementation of programming languages	Professional competencies	**To know:** basic logical methods and techniques of scientific research, methodological theories and principles of modern science; - mathematical apparatus describing the interaction of information processes and technologies at the information, software and technical levels, the theory of neural networks and the principles of use in the design of information systems;- concepts, principles, methods of implementation of programming languages; **Be able to:** carry out methodological substantiation of scientific research; apply modern methods of scientific research to form judgments and conclusions on the problems of information technologies and systems; carry out mathematical formulation of the tasks under study, apply hardware neural networks in the field of information technology ; to analyze scientific results in the field of theoretical foundations of programming languages; independently carry out scientific research in the field of modern theory of programming languages; **To master:** logical and methodological analysis of scientific research and its results;- methods of scientific search and intellectual analysis of scientific information in solving new problems.
	SQL language		**To know:** the basic provisions of the theory of databases, data warehouses, knowledge bases; the 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-tools database design; form and correct database schemas; develop application programs using the SQL language; **To master:** working with database objects in a specific database management system; using database filling tools; applying standard methods for protecting database objects.
4	Programming No Code	Professional competencies	**Know:** the main content of the course has been mastered, allowing to assess the time and capacity complexity of software, but there are difficulties or inaccuracies in the presentation, which the student corrects with leading questions from the teacher; the main content of the course has been mastered, allowing to assess the time and capacity complexity of software, but there are difficulties or inaccuracies in the presentation, which the student corrects independently the content has been mastered, allowing to assess the time and capacity complexity of software, the presentation is clear and competent, without difficulties and inaccuracies

	Low Code Development		**Be able to:** perform all operations that allow to assess the time and capacity complexity of software, but makes mistakes, which he cannot always correct without leading questions from the teacher performs all operations that allow to assess the time and capacity complexity of software, but makes inaccuracies, which he can correct without leading questions from the teacher performs all operations that allow to assess the time and capacity complexity of software; actions are well thought out and free of errors **skills:** demonstrates uncertain mastery of the required skills, existing experience is fragmented, but sufficient to complete the task demonstrates mastery of the required skills, existing experience is sufficient to complete the task demonstrates confident mastery of the required skills, the task is solved quickly and in the best possible way
			Know: the basics of UI/UX design, testing and business analytics. Learn popular No-code platforms (for example, Bubble, Creatio and Webflow). **Be able to:** use prototyping software. Write technical tasks and work with tables. Follow trends in your field. **Skills**: Understand business processes. Understand mailing services, databases, payment systems and other useful things.
4	Parallel computing Multiprocessor computer systems and parallel programming	Professional competencies	**To know:** basic models of parallel computers; fundamentals of parallel data processing; **Be able to:** program and create software products using parallel algorithms in programming languages that support parallelization, as well as using MPI, OpenMP, DVM technologies **To master:** building parallel analogs of computational algorithms.
			To know: an efficient parallel computing algorithm for solving applied problems. **Be able to:** apply computer technology in an automation system; **To master:** choosing the optimal network technologies for information support of the management system
4	Graphic and multimedia design Multimedia software	Professional competencies	**To 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 in global computer networks; store ready-made multimedia products on modern storage devices. **To master:** programming in the Flash Professional environment. methods and means of creating modern multimedia products
			To know: digital video and sound for the presentation of design objects and the development of design projects; the 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 in global computer systems networks; store ready-made multimedia products on modern storage devices. **To master:** programming in the Flash Professional environment. methods and means of creating modern multimedia products
4	Database programming	Professional competencies	**To know**: the basic concepts of building database models, methods and tools for designing relational databases, features of building programs for interacting with databases, DBMS organization, methods of data protection by DBMS, the basics of restricting access rights, the basics of the SQL language for working with data organized in the form of relational databases.; **Be able to:** program databases in programming environment;

	Programming in PHP		**To master:** development of database software for solving economic, scientific and technical problems.
			To know: knowledge of the PHP programming language, development of web application design and programming skills; **Be able to:** use the PHP programming language to develop web applications. The PHP language is designed to solve specific practical problems in the Internet environment. **To master:** 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.	**Name module**	**List of disciplines, incoming V module**	**Semester**	**Volume credit**	**Form of control**	**All loans For module**
M 1	Historical and philosophical knowledge	History of Kazakhstan	2	5	GE	**10**
		Philosophy	4	5	Ex.	
M 2	Socio-political knowledge	Sociology	2	8	Ex.	**8**
		Political science	2		Ex.	
		Cultural studies	1		Ex.	
		Psychology	1		Ex.	
M3	Instrumentation and communication module	Foreign language	1,2	10	Ex.	**25**
		Kazakh (Russian) language	1,2	10	Ex.	
		Information and communication technologies	1	5	Ex.	
M 4	Health promotion	Physical culture	1,2,3,4	8	differential offset	**8**
M.5	Basics economics And ecology	Basics economic and legal knowledge	2	3	Ex.	**5**
		Basics scientific And ecological knowledge	2	2	Ex .	
M 6	Professional communication and languages for the specialty	Professional Kazakh (Russian) language	3	3	Ex.	**6**
		Professionally - oriented foreign language	3	3	Ex.	
M 7	Mathematics And numerical methods	Mathematics 1	1	5	Ex.	**18**
		Mathematics 2	2	3	Ex.	
		Discrete mathematics / Mathematical statistics	4	5	Ex.	
		Numerical Methods/ Optimization Methods and Research operations	6	5	Ex.	
M8	Informational technologies	Packages applied programs / Integrated software systems	3	6	Ex.	**17**

		Computer Architecture/Technology computer And communication systems	1	4	Ex.	
		Informational resources/ Informational resources And technologies	4	6	Ex.	
		Educational practice	2	1	differen tial offset	
M 9	Robotic And intellectual systems	Basics robotics And artificial intelligence / Robotic systems And complexes	5	5	Ex.	**10**
		Technology artificial intelligence	7	5	Ex .	
M10	Software security	Operating systems	4	5	Ex.	**27**
		Basics developments BY / Software security computer	5	5	Ex .	
		Computer networks	5	5	Ex .	
		Parallel calculations / Multiprocessorcomputing systems And parallel programming	7	5	Ex .	
		Software and hardware protection tools information/ Informational safety	7	5	Ex .	
		Production practice	4	2	differen tial offset	
M11	Languages programming	Languages And technologies programming	3	6	Ex.	**31**
		Algorithms And structures data	3	5	Ex .	
		Theoretical Basics developments And implementations languages programming / SQL language	6	6	Ex .	
		Programming on language Python 3 / Analysis data And machine education	6	6	Ex .	
		Web programming / Technology programming	6	6	Ex .	
		Production practice	6	2	differen tial offset	
M12	Graphic modeling	Computer modeling / Mathematical And computer modeling	6	5	Ex.	**15**
		3D graphics And animation	3	5	Ex .	

		Graphic And multimedia design /Multimedia software security	7	5	Ex .	
M13	Theory bases data	Administration bases data	5	5	Ex.	**30**
		Informational management	4	5	Ex.	
		Informational systems / Protection information V informational systems	5	5	Ex.	
		Database programming / Programming V Wednesday PHP	8	5	Ex.	
		Production practice	8	10	differen tial offset	
M14	OOP V Popular Languages Programming	Object-oriented programming/ Programming in the development environment Embarcadero Delphi XE	7	5	Ex.	**22**
		Languages programming C # / Design And development applications	5	5	Ex .	
		Java programming technology / Programming languages	7	5	Ex .	
		Programming No Code/ Low Code / No Code developments	7	5	Ex .	
		Pre-graduation practice	8	2	differen tial offset	
	Final certification	Final certification	8	8	FC	8