ALIKHAN BOKEIKHAN UNIVERSITY

MODULAR EDUCATIONAL PROGRAM
6B06124 "Computational technology and software"

Semey, 2024

Developed by the Department of Information and Technical Sciences

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

Considered and recommended for approval at a meeting of the Academic Council on the quality of the faculty
Protocol № 01 dated February 21, 2024

Considered and recommended for approval at a meeting of the educational and methodological council of the university
Protocol № 5 dated May 28, 2024

CONTENT

1. Explanatory note

The Modular Educational Program (MEP) is compiled on the basis of the following regulatory documents of the Ministry of Education and Science of the Republic of Kazakhstan and internal regulatory documents of Alikhan Bokeikhan University:

- State obligatory standard of higher education, approved by order No. 2 of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022.
- Rules for organizing the educational process on credit technology of education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152;
- Model rules for the activities of organizations of higher and (or) postgraduate education, approved by order of the Minister of Education and Science of the Republic of Kazakhstan dated October 30, 2018 No. 595;
- The structure of the modular educational program, edition No. 3 of 08.10.2021
- Professional standards for "Information Security", and "Artificial Intelligence Application Development" approved by Order No. 222 of the Deputy Chairmen of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 5, 2022.;
- Atlas of new professions "Blockchain technologist"

The MEP is designed as a set of consecutive 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 in the educational program "6B06124 Computer Science and Software".

The modules of the OOD block (a total of 56 academic credits) include disciplines common to all educational programs, in the study of which the graduate must master the competence of general education.

The database block includes disciplines of the university comp1nt (VC) - 40 academic credits and elective comp1nts (EC) – 67 academic credits. The modules of these disciplines form a set of competencies: basic, professional and special competences.

The PD block includes disciplines of the university comp1nt (VC) - 27 academic credits and elective comp1nts (EC) - 42 academic credits. The modules of these disciplines make it possible to form a complex of special and professional competencies acquired by a graduate.

The criterion for the completion of the educational process is the development by the student of at least 240 credits, including at least 232 credits of theoretical training and 8 - final certification. The MOS consists of 16 modules.

When developing a 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 "Interaction of the university with social partners as a condition for high-quality training of graduates" dated February 6, 2024)

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

- Sultanov E.S. – Head of the Monitoring Department of the Semey city Akim's Office,
- Nurgalieva G.E. – Head of the "Regional Innovation and Methodological Center" of the State Institution "Department of Education of the Abai region", KSU
- Matabayeva A.A. – methodologist of the KSU "Regional Innovation and Methodological Center" of the State Institution "Department of Education of the Abai region",
- Kamelkhanov D.B. – Regional representative of Semey city, DAMU Information Technology Development Center LLP,
- Bazhin S.V. - Regional manager of Semey LLP "Center for Information Technology Development of DAMU",
- Turlybaev R.K. - regional representative of JSC "National Information Technologies" of the Abai region,
- Smagulov B.R. – Director of JSC "OESK" of the Abai region,

- Mukanov B.M. – Director of Partner Energo LTD LLP,
- Kazhiakparov A.M. – Director of Dara Stroy Invest LLP,
- Kuznetsov S.A. – Director of the Semey branch of RSE "Kazstandart"
- Nuraldinov A.T. - education department of the Abay region of the education department of the city of Semey, director of the KSU "Secondary school No. 45"
- Tursynzhan A.M. - Director of Good idea group LLP
- A. A. Shcherbakov - Director of DDMARKET LLP.;
- D.K. Chunchubaev - Director of Consulte Service LLP;
- B. A. Sarsembaev, Operations Director, Transtelecom JSC;
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The goal of the modular educational program is to train specialists who are competitive in the labor market, possessing skills in the installation, configuration, and maintenance of system, tool, and application software, computer equipment, and computer systems, as well as programming languages such as Pascal,PHP, C++, Java, JavaScript, and Python.

Expected results of the modular educational program 6B06124 Computational technology and software:

ON1 –to monitor the technological operations carried out by IoT devices, to demonstrate the main areas of application of artificial intelligence systems, its parts and robotics and machine learning methods for solving application programs.

ON2 –evaluate the technical support of hardware and software for information security, analyze the basic concepts and definitions in the field of information systems and information processes

ON3 – Analyze the actions of software development processes, standards, methods, tools, actions and obligations related to the development and qualification of all requirements.

ON4 – formulate technical requirements taking into account the functions performed by computing systems and configuration, installation, methods and means of restoring the operability of network equipment and distributed systems.

ON5 – understand the basic concepts of blockchain, the advantages and limitations of blockchain technologies, the key differences between blockchain and other technological systems, plan, design, implement and test end-to-end dApps with proper configuration of the blockchain network on an enterprise scale, apply protocols in web3 applications, have detailed knowledge of the basics of programming procedures and functions, PC and its main technical characteristics and functional capabilities; professional problems in the field of computing and telecommunications.

ON6 - have a good understanding of no-code/low code tools, the Ethereum model, consensus model, execution code, network operation, data storage options and the main actors who participate in its protocol, the various levels of components that make up the architecture of a blockchain-based system, the principles of object-oriented programming

ON7 – to summarize information, prepare references and reviews on professional issues, edit, review, and review texts. Demonstrate knowledge of the documentation requirements accepted in professional communication, an understanding of oral speech within a professional topic, and select the necessary information from foreign language sources.

ON8 - formulate systematic knowledge about modern programming languages, tasks in programming languages, methods and tools for software development; analyze tasks in programming languages, configure development tools, conduct software code reviews, develop various types of software requirements

ON9 – have a good understanding of mathematics, statistics, mathematical model and problem solving, computer modeling.

ON10 – demonstrate knowledge and skills in the use of fundamental physical laws and theories, as well as methods of physical research, solving global problems and using analogues between phenomena of different nature, analyze general information about the element base of circuit engineering, functional nodes, calculation and design of electronic devices, circuits and devices of various functional purposes in accordance with the terms of reference and with using design automation tools, principles of building microprocessor systems, software and logic model of microcontrollers.

ON11 - To use modern computing tools for the basics of cloud technologies and computer modeling;

ON12 – apply methods and tools for designing databases, system programming and operating systems at the software development level

ON13 – describe the basic concepts of component programming technologies

ON 14 – Demonstrate knowledge about the idea of a modern rule of law to instill skills of financial literacy, entrepreneurship, leadership, receptivity to innovation based on scientific research in compliance with the principles of academic integrity, as well as ensuring safety standards

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

2. Competence model of a graduate

Competences that a graduate of the educational program 6B06124 «Computational technology and software» should have:

Competences of general education

- aimed at forming the 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;
- they 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 spheres of their lives and activities;
- form life-long self-development and education skills;
- they 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;
- to assess situations in various spheres of interpersonal, social and professional communication, taking into account the 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 choose 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;
- Russian and foreign languages, using linguistic 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 enter into communication in oral and written forms in Kazakh, Russian and foreign languages, using linguistic 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;
- to carry out the proof of mathematical statements, solve mathematical problems and problems, identify their essence, translate into mathematical language problems posed in terms of other subject areas, in particular it technologies;
- set mathematical problems; build mathematical models;
- select suitable mathematical methods and algorithms for solving problems;
- conduct high-quality mathematical research.
- apply the basic methods of formalization of reasoning, the basic concepts of the theory of logical functions, the theory of algorithms, graph theory, coding theory;
- to use the conceptual apparatus and methods of discrete mathematics for the analysis of mathematical models used in computer calculations in solving engineering and design problems;
- apply theoretical knowledge to solve generalized typical physical problems
- conduct a physical experiment;
- calculate, analyze and process the results of a physical experiment;
- select the elements of electronic circuits, make the necessary calculations, make a mathematical description of the functioning of devices and determine their characteristics;

- determine the parameters of semiconductor devices and circuit elements, use methods for constructing various models of data types, information processing algorithms;

Professional competencies:

- identify potential threats and dangers, apply methods and tools to ensure the security of software products;
- apply the basic concepts of system programming, develop programs covering system programming issues;
- organize the protection of information from unauthorized access
- formulate technical requirements taking into account the functions performed by computing systems;
- identify tools for evaluating system performance;
- use a unified modeling language, install architectures and key points of distributed client-server applications;
- to apply technologies of network interaction of communication systems, to create applications of network interaction of means, to implement a structural and approach to working with tools;
- apply basic methods of mathematical analysis and modeling, theoretical and experimental research;
- possess mathematical apparatus in solving professional problems;
- compress and archive information;
- use general-purpose application programs;
- rationally use the opportunities provided by the algorithmization technique to solve practical problems;
- formulate technical requirements taking into account the functions performed by computing systems;
- identify tools for evaluating system performance;
- have an idea about the features of artificial intelligence tasks and the role of logic programming as a methodology for solving these problems, knowledge representation models, methods for developing and creating expert systems and expert shells;
- use professional Russian (Kazakh) language in interpersonal communication and professional activity;
- to develop the ability to transmit scientific information and literature of a socio-political nature.

Special competencies:

- program in modern algorithmic languages, understand the fundamental principles of software construction;
- possess various approaches in programming methodology, know paradigms
- modular and object-oriented programming.
- use a unified modeling language, install architectures and key points of distributed client-server applications;
- to apply technologies of network interaction of communication systems, to create applications of network interaction of means, to implement a structural and object-oriented approach in working with tools;
- perform typical tasks of designing, deploying and maintaining local and global networks; administer networks in modern operating systems
- to establish architectures and key points of distributed client-server applications, to apply technologies of network interaction of communication systems, to create applications of network interaction;
- be able to apply the general principles of creating distributed systems; owns the means and methods of building and organizing distributed systems;

- use the basic structures and mechanisms of various operating systems, work with modern operating systems;
- know XML, HTML5 layout, principles of stylistic design —CSS, document model processing mechanisms;
- develop web scripts, program in PHP, JavaScript
- determine the key characteristics of the blockchain
- business opportunities, design and develop new blockchain-based services, as well as create and develop a successful business

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

No.	Competencies	The list of compulsory, elective disciplines and the sequence of their study		Expected results
		List of disciplines	The sequence of their study (sem.)	
1	Special competencies	Theory of information processes	3	**Know:** – fundamentals of information culture; principles and structure of information processes and systems; – assignment and classification of software tools for digital information processing; **Able to:** – to use IP theory, information processes and computer technology in solving specific practical problems; – to evaluate the problems of the relationship between the individual, human society and nature; – to identify the effect of physical laws in the processes and phenomena of nature; to develop proposals for the organization of information processes and systems when using the information space using modern technologies, digital assets; – choose network technologies and automated document management tools of the organization; **Possess skills**: – methods of organization and use of database management systems; methods of organization and evaluation of the effectiveness of the information space of the organization; – methods of working with application software
		Information technologies	3	**Know**: - basic concepts: information and information technology; - technologies for collecting, storing, transmitting, processing and providing information; - identification and authorization of users and network resources; - information security: the main types of threats, ways to counter threats **Able to:** - work with graphical operating systems of a personal computer (PC): enable, disable, manage sessions and tasks performed by the operating system of a personal computer; **Possess skills:**

				- presentation of information; - search for files, computers and network resources;
2	Special competencies	Decentralized applications	4	**Know:** – planning, designing, implementing and testing end-to-end dApps with proper configuration of the blockchain network on an enterprise scale; **Able to:** – understand the architecture and components of DApp, including the external interface and internal processing supported by blockchain and smart contracts; **Possess skills:** - critically evaluating new blockchain standards and architectures and applying them in various use cases.
		LMS technologies	4	**Know:** – Basics of conducting practical classes in the chat – registration of electronic documents and import of documents from alternative formats. **Able to:** – Use of test technologies (development of test tasks (tests), analysis of test results). **Possess skills:** – Formation of skills for setting up an e-course assessment; Formation of skills for working with reports and logs of the electronic course
		Programming No Code/Lo Code	4	**Know:** – the main content of the discipline has been mastered, which allows assessing the temporal and capacitive complexity of the 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 discipline has been mastered, which allows evaluating the temporal and capacitive complexity of the software, but there are difficulties or inaccuracies in the presentation, which the student corrects independently – the content has been assimilated, which makes it possible to assess the time and capacity complexity of the software, the presentation is clear and competent, without difficulties and inaccuracies

3	Special competencies			**Able to:** – performs all operations that allow evaluating the time and capacity complexity of the software, but makes mistakes that are not always able to eliminate without leading questions from the teacher – performs all operations that allow evaluating the time and capacity complexity of the software, however, it allows inaccuracies that it can eliminate without leading questions from the teacher – performs all operations that allow you to evaluate the time and capacity complexity of the software; the actions are thought out and do not contain errors **Possess skills:** – demonstrates an uncertain command of the required skills, the available experience is fragmentary, but sufficient to complete the task – demonstrates possession of the required skills, the available experience is sufficient to complete the task – demonstrates a confident command of the required skills, the task is solved quickly and in an optimal way
		Object-oriented programming	4	**Know:** – what is a class and an object; – basic principles of object-oriented programming; – principles of class construction; – criteria for verifying the correctness of class construction; – main trends in the development of object-oriented programming technologies; **Able to**: – use modern methods of object-oriented programming when coding software systems of different levels of complexity; **ɔssess skills:** ɔrking with the Delphi visual programming environment; – basics of algorithmization;

4	Special competencies	Operating systems	5	**Know:** - the concept, principles of construction, types and functions of operating systems; - operational environment; - machine-independent properties of operating systems. **Able to:** - install and maintain operating systems; - take into account the specifics of working in a particular operating system, organize support for applications of other operating systems; - use the tools of the operating system. **Possess skills:** - security and fault tolerance of operating systems; - principles of building operating systems; – ways to organize device support, hardware drivers, network operating systems.
		Operating systems, environments, and shells	5	**Know:** – the current state of the level and directions of development of computer technology and software; – main stages, methods, tools and standards of software development; – main types of operating systems, principles of resource management in the operating system; – features of working in specific operating environments and shells; – service software tools; – ways of organizing, storing and processing information on a computer. **Able to:** – work in the selected environment; – master a new operating system or software shell; – get information about users, processes, directories, help about system commands; – exchange messages with other users; eate and view directories, copy, move and delete files, manage file access mode; - create, view and merge text files, perform a template search, search for files by specified properties, use pipelines and I/O redirection. **Possess skills:** – security and fault tolerance of operating systems; – principles of building operating systems and shells; – ways to organize device support, hardware drivers, network operating systems.

5	Special competencies	Microcontrollers and microprocessor systems	5	**Know:** – software and logic model of the microprocessor 1810VM86; – operating modes of the microprocessor 1810 VM86; – principles of building microprocessor systems; – a software-logic model of microcontrollers of the 1816 series; – operating modes of the micro-computer 1816 VE48; **Able to:** – build microprocessor systems based on kits 1816 and 1810; – test microprocessors as part of computers; **Possess skills:** – drawing up electronic circuits for the operation of microprocessors and switching methods
		Fundamentals of microprocessor technology	5	**Know:** – principles of construction of electronic devices based on modern element base and MPS; – principles of functioning of electronic devices based on modern element base and MPS; – main technical parameters, operational characteristics and applications of the main devices and functional components of electronics and MPS; – the basic principles of designing circuits based on MPS. **Able to:** – carry out the design and calculation of standard MPC nodes; – to select the MPS for the required task. **Possess skills**: – performing analysis and synthesis of electronic circuits with MPS; design and calculation of electronic devices using a computer.
6	Special competencies	Computer networks and telecommunications	6	**Know**: – Main components of the network, types of communication lines – Types of IP addresses – Methods and means of network protection – PHP syntax – SQL syntax – Types of domain and types of hosting **Able to:** – Create personal account schemes

				– To clean the PC from viruses – Apply EDS – Apply encryption principles – Create PHP applications – Create websites with DB – Create a database using phpmyadmin and SQL – To process form data – **Possess skills :** – Creating a personal account scheme – Configure and administer the network – Creating applications in PHP – Creation and maintenance of websites – Publishing web sites on the Internet System and Network Administration
		Technics of computer and communication systems	5	**Know:** – features of monitoring and diagnostics of hardware and software systems devices; – basic diagnostic methods; – application of service tools and built-in test programs; – hardware and software configuration of computer systems and complexes; **Able to:** monitor, diagnose and restore the operability of computer and communication systems; - to carry out system maintenance of computer and communication systems; **Possess skills:** – monitoring, diagnostics and restoration of computer and communication systems operability; system maintenance of computer and communication systems;

7	Special competencies	Object-oriented programming in C++	6	**Know:** – the concept of object-oriented programming, its main concepts (class, object), properties (encapsulation, inheritance, polymorphism); – methodology of analysis and design of object-oriented programs; – basic concepts, syntax and semantics of C++ programming language constructs; – methods of composing object-oriented programs in the C++ programming language; – features of the integrated programming environment in C++. **Able to:** – debug and test programs written in C++; – formulate the statement of tasks; perform a formalized description of the task, its algorithmization; – based on the existing algorithm to build a computer program in algorithmic languages and C++. **Possess skills:** – on object-oriented design; development of object-oriented program code in modern operating systems.
		Functional programming	6	**Know:** – features of artificial intelligence tasks and the role of functional programming as methodologies for solving these tasks; – trends and prospects of development of functional programming tools; – fundamentals of the theory and practice of lambda calculus. **Able to:** – develop software applications for solving tasks in a functional programming language; – develop algorithms for solving problems for functional programming **Possess skills:** – work with software applications to solve tasks in a functional programming language; – development of algorithms for solving problems for functional programming

8	Special competencies	Setting up, repair, optimization and maintenance of computer systems	3	**Know:** features of monitoring and diagnostics of hardware and software systems devices; basic diagnostic methods; - hardware and software tools for functional control and diagnostics of computer systems and complexes capabilities and applications of standard and special control and measuring equipment for localization of fault locations of SVT; application of service tools and built-in test programs; hardware and software configuration of computer systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs; techniques for ensuring the stable operation of computer systems and complexes. **Able to:** to monitor, diagnose and restore the operability of computer systems and complexes; to carry out system maintenance of computer systems and complexes; take part in debugging and technical testing of computer systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs. **Possess skills:** monitoring, diagnostics and restoration of the operability of computer systems and complexes; system maintenance of computer systems and complexes; debugging of hardware and software systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs.
		Maintenance and repair of computer systems and complexes	3	**Able to:** – to monitor, diagnose and restore the operability of computer system complexes; – to carry out system maintenance of computer systems and complexes; – take part in debugging and technical testing of computer systems and complexes, installation, configuration and configuration of the operating system, drivers, resident programs; – comply with safety regulations; **Know:** – features of monitoring and diagnostics of hardware and software systems devices; basic diagnostic methods; – hardware and software tools for functional control and diagnostics of computer systems and complexes, possibilities and applications of standard and special monitoring and

				measuring equipment for localization of fault locations of SVT; – application of service tools and built-in test programs; – hardware and software configuration of computer systems and complexes; – installation, configuration and configuration of the operating system, drivers, resident programs, techniques for ensuring the stable operation of computer systems and complexes. **Possess skills:** monitoring, diagnostics and restoration of the operability of computer systems and complexes;
9	Special competencies	Smart Contract Architecture	6	**Know:** Ethereum models, consensus models, execution code, network operation, data storage options and the main actors who participate in its protocol; the inner workings of smart contracts as a means to develop decentralized applications; **Able to**: - develop smart contracts using the Solidity programming language (including a deep understanding of the libraries provided); - to understand the interaction between the closed network of smart contracts and the outside world, to realize the further consequences of these interactions for the aspect of decentralization; **Possess skills:** - use of the smart contract development lifecycle (contract implementation, testing, deployment and contract migration); – a set of technologies that support a backbone decentralized data storage network (for example, IPFS, Swarm).
		Working with Ethereumm	6	**Know:** - algorithmic programming languages, operating systems and shells, modern software development environments **Able to**: – make algorithms, write and debug codes in the programming language, test the program's performance, integrate program modules **Possess skills**: programming language; debugging and testing skills of the program
10	Special competencies	Internet of things	6	**Know:** - principles of organization and functioning of the Internet of things - The history of the emergence and development of the "Internet of Things" - the main factors of the development of the "Internet of things" - Existing technologies in the Internet of Things industry - The main trends and trends in the field of "Internet of Things".

				Able to: - work with microcontrollers and basic repair plates (Arduino and Raspberry Pi)) - understand existing IoT technologies and their application to specific scenarios - design of integrated IoT systems (including end devices, network connections, data exchange, cloud platforms, data analysis). **Possess skills:** - terminological apparatus - basic end device programming skills - basic skills for connecting end devices to the network - basic cloud technologies for the development of software solutions for data processing and storage.
		Design of Distributed Control Systems	6	**Know:** – properties, characteristics and architectures (structures and topologies) of distributed control and automation systems (DCS), – types of support {methodological, technical, software, informational, metrological, ergonomic and organizational-legal); - functional tasks and performance criteria of the DCS; **Able to:** – to carry out projects of automation tools, automation systems of technological processes: – perform automation of scientific research and testing: – design and implement algorithms for preprocessing information (compression, filtering, improving the accuracy of conversion, etc.), – to determine the network section with the maximum delay of IP packet transmission; – generate HTTP requests and analyze HTTP response fields; – develop hypertext documents. **Possess skills**: ɾ- forming formal construction and transformations of analytical and simulation models of DCS; - application of methods and techniques of analysis and synthesis of DCS architectures; velopment and use of analytical and simulation models of DCS to evaluate design solutions; - implementation of the sequence of stages of design of control and automation systems.

11	Special competencies	Database programming	6	**Know:** – tasks and principles of database development; – database models; – types of database management system; – basic concepts of database theory; – basic data models; – normal forms of relational relations; – Structured SQL query language. **Able to:** – use tools that support software development of professionally-oriented information systems; – use technical means of information systems in the subject area; – create database tables; – perform basic techniques for working with datasets: navigating a dataset, searching for records in a dataset, filtering records, etc.; – create SQL queries; **Possess skills:** – data model development; – database application development; – using the SQL language; – work with modern DBMS.and storage.
		Programming on 1C	6	**Know**: – principles of construction of automatic machine tool systems and fundamental theories of automation of production processes; – features of automation of assembly processes; – target mechanisms of automatic machines and automatic lines; **Able to**: – design separate target mechanisms of automatic machines and automatic lines; – design automatic machine tool systems; – perform calculations of the performance and reliability of automatic equipment; **Possess skills:** – analysis of the performance, reliability and economic efficiency of automatic lines; – processing and analysis of statistical information on reliability, performance and improvement of operational efficiency of automatic systems

				of DCS; – application of methods and techniques for analysis and synthesis of DCS architectures; – development and use of analytical and simulation models of DCS for evaluation of design solutions; – implementation of the sequence of stages in the design of control and automation systems
12	Special competencies	Computer modeling	7	**Know:** basic concepts of modeling theory, classification of models and areas of their use, modeling tasks; basic modeling tools used in the process of designing systems at different stages of project detail; methods of modeling and analysis of systems; principles of model construction. **Able to:** perform an analysis of the system or process under study; reasonably choose a modeling method; build an adequate model of a system or process using modern computer tools; interpret and analyze the simulation results. **Possess skills:** the main criteria for evaluating the obtained simulation results; experience in the work and use of scientific and technical information in the course of modeling.
		3D graphics and animation	7	**Know:** – basic concepts of three-dimensional graphics; – main features of the 3D Studio MAX program; **Able to:** – create a stationary three-dimensional scene in accordance with the rules of artistic and technical design, taking into account color and texture solutions; – create a simple animated three-dimensional scene using the 3D Studio MAX program; **Possess skills:** – Creating 3D graphics in 3D Studio MAX, Autodesk 3ds Max and AutodeskMaya 3d. – Develop graphic and multimedia design

13	Special competencies	Modern methods and means of Java programming	7	**Know:** – data types, characteristics, operations, language operators; – principles of object-oriented programming; – Fundamentals of computer networks and network associations, Internet services, concepts, Java programming environment. **Able to:** – use classes to process applications; – work with files; use the principles of building a graphical interface, graphical primitives; convert applets. **Possess skills:** – work with operators, with arrays of application processing; – creating classes, class methods, publishing objects; – creating client components and applications; – works with Java network technologies.
		Modern methods and means of NET programming	7	**Know:** – data types, characteristics, operations, language operators; – principles of object-oriented programming; – fundamentals of computer networks and network associations, Internet services, concepts, NET programming environment. **Able to:** – use classes to process applications; – work with files; use the principles of building a graphical interface, graphical primitives; – convert applets. **Possess skills:** – work with operators, with arrays of application processing; – creating classes, class methods, publishing objects; – creating client components and applications; – works with NET network technologies.
14	Special competencies	The use of data in machine learning	7	**Know**: - principles of constructing feature vectors, decision rules, and classification; - the main types of classifiers; - principles of construction of linear classifiers; - principles of construction of nonlinear classifiers; - selection of classification features and features of data preprocessing. **Able to**: - choose the appropriate type of classifier depending on the task being solved;

				- select feature sets for classification and pre-processing data; - use algorithms for training and compiling a classifier for selection; - perform calculations related to the study and operation of the classifier in the MATLAB environment **Possess skills:** – - selection, creation, training and use of basic classifiers problem solving
		Introduction to machine learning and data analysis	7	**Know**: - the main ways of data transformation; - the main stages of the machine learning project **Able to**: - working with arrays - Formalize business tasks as machine learning tasks - find solutions to machine learning problems in specific business tasks **Possess skills:** - loading, converting, cleaning and visualizing data in python - application of machine learning models in python - quality assessment and interpretation of the results obtained
15	Special competencies	Architecture of the blockchain system	7	**Know:** – the inner workings of smart contracts as a means to develop decentralized applications; – interaction between a closed network of smart contracts and the outside world, – about the further consequences of these interactions - to understand the set of technologies that support the network's core decentralized data storage network (for example, IPFS, Swarm, Filecoin) **Able to:** – define the key characteristics of the blockchain (i.e. decentralization, permanence, anonymity, verifiability, etc.); – explain the different levels of components that make up the architecture of the blockchain-based system; – understand the problems of consensus algorithms at a high level; – understand algorithmic execution in DLT, their consensus model, code execution, its network operation, storage options and the main actors who participate in each protocol; – understand the underlying incentive and management models; **Possess skills:** – forecasting the development and implementation of DLT in the future based on various use cases;

				understanding how other emerging technologies (for example, IoT and AI) can be used in combination with blockchain
		Ethereum, Web3 and Truffle development environments	7	**Know:** – information about the Ethereum network node **Able to**: – rent a virtual or cloud server from one of the providers **Possess skills:** working with the Geth node

16	Special competencies	Programming on PHP	7	**Know**: – assignments, functions, classification of PHP programming, – principles of operation of Internet services; – principles of organization and operation of web information processing technologies and the Internet **Able to**: – создавать статические и динамические страницы. – создавать концептуальное предложение в WEB страницах с использованием технологий для создания сайта и опубликовать его в Интернете **sess skills:** – programming and client-server technologies.
		Web programming	7	**Know:** - technologies for developing static websites; - techniques for using multimedia (graphics, video, animation) on web pages; - client-side software tools used to create web pages; **Able to:** - design and develop the structure of the site; - use HTML hypertext markup language and cascading style sheets (CSS) to create web pages; - develop scripts in the JavaScript programming language; **Possess skills:** creation of web sites;
17	Special competencies	Blockchain Business Models	7	**Know:** – business opportunities, design and develop new blockchain-based services, as well as create and develop a successful business; **Able to**: – develop ideas and innovative strategies; **Possess skills:** development of a business model that conforms to the principles of digital currencies, decentralization and the growth of peer-to-peer transactional relationships between producers and consumers.

		The basics of blockchain and cryptocurrencies		**Know:** – features and principles of functioning of cryptocurrencies, their types; – the importance of blockchain technology in the functioning of cryptocurrency instruments; – the main types of consensus in blockchain technology: PoW (Proof-of-work) and PoS (Proofof-stake); – the main ways to invest in cryptocurrencies; – features of existing cryptocurrency trading platforms; **Able to**: – to develop the specifics of legal regulation of operations on the cryptocurrency market in different countries of the world; – to solve the problems of state regulation in the application of blockchain technology and the use of cryptocurrencies; **Possess skills:** raising funds through the mechanism of initial coin issuance (ICO).
18	Special competencies	Distributed systems technologies	7	**Know**: – principles of building distributed information processing systems; – communication in distributed systems; – types of links; – the concept of a transaction **Able to**: – use technologies for building and operating distributed information systems. **Possess skills**: - work with modern systems of design and development of distributed systems
		Technologies for the development of distributed information systems	7	**Know:** –current trends in the development of computer science and computer technology, computer technology; –fundamentals of creating information systems and the use of new information technologies for information processing; **Able to:** –apply mathematical methods, physical laws and computer technology to solve practical problems; –program in one of the algorithmic languages; –apply information retrieval algorithms in software development. **Possess skills**:

				–drafting projects for the development of modern software; –technologies for collecting, processing, transmitting and storing information. –software development comparative analysis of the choice of tools.
19		Fundamentals of robotics and artificial intelligence	7	**Know**: – mathematical models of automation and robotization systems of production processes using modern software products; **Able to**: – design automation and robotics systems; comparative analysis using modern software products for the robotization of technological complexes and automation systems of production processes in various industries, as well as artificial intelligence methods.; **Possess skills**: – formation of modern trends in the development of robotics systems and automation of production processes
		Robotic systems and complexes	7	**Know**: – industrial robot control systems; about remotely controlled robots; **Able to**: – solve programming problems using robotic systems **Possess skills**: – formation of work on the organization of processing; – organization of work on the collection, storage and processing of information used in the field of professional activity

20	Special competencies	Software development technology	7	**Know:** – current trends in the development of computer science and computer technology, computer technology; – fundamentals of creating information systems and the use of new information technologies for information processing; **Able to:** – apply mathematical methods, physical laws and computer technology to solve practical problems; – program in one of the algorithmic languages; – apply information retrieval algorithms in software development. **Possess skills**: – drafting projects for the development of modern software; – technologies for collecting, processing, transmitting and storing information. – software development – comparative analysis of the choice of tools.
21		Software development process	7	**Know:** - theoretical foundations of instrumental software; classical and modern methods of building the information structure and interface of the tool. **Able to:** choose tools when creating software; apply software building standards; to evaluate the effectiveness of the tools and analyze the qualitative characteristics; to realize the economic efficiency of the software; - apply object-oriented and structured distribution methods in control and measuring devices. **Possess skills:** software development; – comparative analysis of the choice of tools.
		Introduction to Web 3	5	**Know:** smart contract deployment; **Able to:** apply protocols in web 3 applications **Possess skills:** applications of decentralization in applications; web 3 application development;

		Introduction to Internet Marketing	5	**Know:** – key concepts, goals and objectives of Internet marketing; specifics of the work of projects in the Internet space; characteristic mistakes that should be avoided in Internet projects; – how to competently build business communication; – theoretical foundations of business communications, their main types and materials; – business communication, its structure and principles; – psychological characteristics and types of subjects of the communicative process **Able to:** – to compose and describe the entire life cycle of an Internet project, starting from the birth of an idea and ending with extinction; – to analyze any segment of the Internet business, to evaluate the effectiveness, monetization, work with the audience; – prepare analytical reports on all areas of the project's life (market analysis, competition assessment, promotion methods, approaches to working with the audience, quantitative indicators, sources of funding); – formulate questions, critically evaluate the selection of promotion tools; **Possess skills:** –information in global computer networks and corporate information networks; –the use of modern tools used in carrying out a complex of works on Internet marketing; –business communication technologies, a wide range of communication techniques and techniques for establishing contact with the interlocutor, creating an atmosphere of trusting communication; –organization of feedback for the purpose of their effective use in professional activities; methods of cognition of the personality of the communication partner

Table 2. The sequence of mastering the disciplines of social and professional interaction

Well	Supporting disciplines	Competencies	Expected Result
General education disciplines			
Required Comp1nt			
1	History of Kazakhstan	Competencies general education	**Know:** – demonstrate knowledge and understanding of the main stages in the 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; – objectively and comprehensively comprehend the immanent features of the modern Kazakh model of development; **Master the skills::** – analytical and axiological analysis in the study of historical processes and phenomena of modern Kazakhstan; – systematization skills and give a critical assessment of historical phenomena and processes in the history of Kazakhstan
1	Information and Communication Technologies	Competences of general education	**Know:** – what economic and political factors contributed to the development of information and communication technologies; – features of various operating systems, architecture; **Be able to:** – determine the main trends in the field of information and communication technologies; – use information resources to search and store information; – work with spreadsheets, perform data consolidation, build graphs; – apply methods and means of information protection; design and build simple websites; – to process vector and raster images; create multimedia presentations; – use different communication platforms; – calculate and evaluate the performance indicators of supercomputers; – use various forms of e-learning to expand professional knowledge; – use various cloud services. **Master the skills:** – database structure development; – designing and creating presentations;

			– receiving data from the server; – creating video files; – work with Smart-applications; – work with services on the e-government website.
	Foreign language	Competencies general education	**Know**: – lexical minimum and language material of topics and subtopics in a given discipline (social and social and 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 messages on the radio, at the airport, at the station. – understand when reading the content of short, simple texts, advertisements, brochures, menus, bus and train timetables, short simple personal letters, e-mails. – communicate in simple typical situations that require the exchange of information within the framework of familiar topics and activities, be able to talk about the family, living conditions, training sessions. – write a simple letter of a personal nature, a note, an autobiography. **Master the skills::** – understanding of foreign language dialogic and monologue speech within the framework of general cultural and professional topics; – a foreign language at a level that allows 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.

	Kazakh (Russian) language	Competencies general education	**Know:** – theoretical foundations of the course (language, its functions, forms of speech, text, its features, styles of speech, functional and semantic types of speech); – features of dialogic and monologue speech; – types of scientific information and the specifics of its implementation in a scientific text; – elements of structural-semantic analysis and semantic analysis of a scientific text, comp1nts of a speech situation, speaker's intentions. **Be able to:** – to carry out the correct choice and use of language and speech means for solving certain problems of communication and cognition on the basis of knowledge of a sufficient amount of vocabulary, a system of grammatical knowledge, pragmatic means of expressing intentions; – compose everyday, socio-cultural, official and business texts in accordance with generally accepted norms, functional orientation, using lexical-grammatical and pragmatic material of a certain certification level that is adequate to the goal; – convey the factual content of texts, formulate their conceptual information, describe inferential knowledge (pragmatic focus) of both the entire text and its individual structural elements; – interpret text information, explain in the scope of certification requirements the style and genre specificity of texts of socio-cultural, socio-political, official business and professional spheres of communication; – participate in communication in various situations of different spheres of communication in order to realize their Master the skills: intentions and needs (everyday, educational, social, cultural), declaring them ethically correct, meaningfully complete, lexico-grammatically and pragmatically adequate to the situation; – discuss ethical, cultural, socially significant issues in discussions, express their point of view, defend it with arguments, critically evaluate the opinion of interlocutors; – build speech behavior programs in situations of personal, social and professional communication in accordance with the norms of the language, culture, specifics of the sphere of communication, certification requirements; – request and communicate information in accordance with the situation of communication, evaluate the actions and deeds of participants, use information as a tool to influence the interlocutor in situations of cognition and communication in accordance with certification requirements. **Master the skills::** – skills of producing oral and written speech in accordance with the communicative goal 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	Competencies general education	**Know:** – basic philosophical concepts and categories, patterns of 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, the methods of philosophical research; – the place and role of philosophy in public life; **Be able to:** – use the foundations of philosophical knowledge to form a worldview position; – analyze worldview, socially and personally significant philosophical problems; – navigate the system of philosophical knowledge as a holistic view of the foundations of the universe and the prospects for the development of planetary society; – understand the characteristic features of the modern stage of development of philosophy **Master the skills::** – the skills of philosophical analysis of various types of worldview; – philosophical thinking skills to develop a systematic, holistic view of the problems of society; – skills in analyzing texts with philosophical content
1	Sociology	Competencies general education	**Know:** – patterns and stages of the historical process, basic historical facts, dates, events and names of world and domestic historical figures; – 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 the philosophical worldview to the field of material and practical activity; – use various philosophical methods to analyze trends in the development of modern society, philosophical and legal analysis **Master the skills::** – skills of a holistic approach to the analysis of society's problems; – methods of philosophical, historical and culturological research, techniques and methods for analyzing the problems of society; – causal relationships in the development of Kazakhstani society; – the place of man in the historical process and the political organization of society; – skills of respectful and careful attitude to the historical heritage.

1	Political science	Competencies general education	**Know:** – the main stages in the development of political knowledge in the history of civilization; – schools and directions of modern political science; – the political life of society; – the political system and its institutions; – the essence of political processes in the country and the world. **Be able to:** – analyze the features of political systems and the functioning of political institutions; – critically evaluate the theoretical approaches of political science; – identify interrelations and patterns of the political process; – to compare political systems, institutions and actors in a cross-country and sub-national context, based on the knowledge gained and the methods mastered. **Master the skills::** – Have the skills (gain experience) of working with primary sources on the topics of the course; analysis of normative legal acts and other documents; search, processing and analysis of information; solving problems related to the assessment of the political course; group work, project activities, business games; public speaking; academic writing.
1	Culturology	Competencies general education	**Know:** – basic theories of culture, basic concepts of cultural studies; the main directions of the methodology of modern cultural analysis; – the history of the formation of world culture and civilization, the theoretical features of basic cultural

			concepts, various interpretations of culture and civilization in world and domestic literature; – actual problems of development of modern culture; – the idea of culture as a socio-historical phenomenon; – patterns of development of world cultures, as well as the typology of the classification of cultures; – basic knowledge about the history of the most important cultures of mankind; – on the ways of acquiring, storing and transferring the basic values of culture – about the diversity and intrinsic value of different cultures, forms and types of culture, the patterns of their functioning and development, the main cultural and historical regions – the history of Kazakh culture, its place in the system of world culture and civilization **Be able to:** – be able to highlight the features of a given culture, its dominant values; – explain the specifics of intercultural communication; – be able to conduct independent professional activities in a dynamically changing multicultural society; – be able to navigate in the cultural environment of modern society; – be able to explain the phenomenon of culture, its role in human life; – be able to navigate in cultural issues, to independently understand the influence of cultural factors on the behavior of individuals; **Master the skills::** – practical skills to preserve and enhance the national and world cultural heritage; – practical skills in the practical use of knowledge and skills in matters of taking into account the specifics of the cultural behavior of various individuals and groups in the current conditions of the formation of civil society in the Republic of Kazakhstan.
1	Psychology	Competencies general education	**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 methods of effective communication. **Be able to:** – interpret basic psychological theories, concepts; – use methods and mechanisms of regulation of emotions in everyday life; – identify patterns of behavior in a conflict situation and conduct self-diagnosis. **Master the skills::** – definitions of individual psychological characteristics of a person, value-semantic representations in the pro-

			fessional self-determination of a person; – recognition of psychological impact and effective communication.
1	Physical Culture	Competencies general education	**Know:** – the role of physical culture in the development and training of a specialist; – fundamentals of the state policy of the Republic of Kazakhstan in the field of physical culture and sports; theoretical and methodological foundations of physical culture; – the main achievements of the Republic of Kazakhstan in the field of physical culture; – hygienic and organizational bases of physical culture and sports. **Be able to:** – to use in life practical skills that ensure the preservation and strengthening of health, the development and improvement of psychophysical abilities and qualities; – use physical culture, sports and recreational activities to achieve life and professional goals; – apply the rules for the safe conduct of physical exercises and sports. **Master the skills::** – skills in organizing mass sports competitions; – exercises on professional - pedagogical physical training of general physical training, special physical training, as well as to put into practice special games; – a system of practical skills that ensure the preservation and strengthening of health, the development and improvement of psychomotor abilities and qualities.
General education disciplines			
University comp1nt			
1	Fundamentals of economic and legal knowledge	Competencies general education	**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.

			Skills: 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.
	BASIS OF SCIENTIFIC AND Ecological THINKING	Competencies general education	**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; **the skills of** 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.
Basic disciplines			
University comp1nt			
	Introduction to Programming	Professional competencies	**Know:** – Features of the structure, organization and practical implementation of algorithms; – Algorithms and data structures; – Creating documentation; – Unit testing; – Knowledge of the basics and prospects for the development of new technologies; **Be able to:** – Python syntax ; – selection of the necessary technology, library or tool. – apply algorithmic languages and methods to ensure the functioning of objects of professional activity; – Mastering the skills of the user on a personal computer, the basic concepts and methods of modern practical programming.;

			– Understanding the principle of the Ide; – use algorithmic languages to create a program model**Master the skills:** – basic technologies and mechanisms used in information and computer systems when programming; – performing and reading engineering drawings in the specialty, for example, drawings of parts and assemblies that are part of the equipment of the printing industry – studying and acquiring basic information about state standards ESKD, ESTD, SNDS in the specialty. **Master the skills** - development of algorithms and program structure for solving problems; - Skills in designing and creating Python programs; - Working with Python operators; - full understanding of the content of modular and modern object-oriented programming;
1	Maths	Basic competencies	**Know:** – basic concepts of higher mathematics and applications in various fields, techniques and methods for specific tasks,basic concepts of sets; algebraic methods for describing models; – elementary functions of the algebra of logic, properties and their analytic representation; – fundamentals of logical calculus of propositions and predicates; – methods for solving classical problems formulated in terms of combinatorics; – basics of coding. **Be able to:** – build mathematical models; – set mathematical problems; – select appropriate mathematical methods and algorithms for solving the problem; – conduct high-quality mathematical research. **Master the skills**: elements of analytical geometry, linear algebra, solving professional problems;
	Professional Kazakh (Russian) language	Professional competencies	**Know:** – professional vocabulary and terminology; – the specifics of oral communication in the professional field; – language features of oral and written communication; – features of business communication and business etiquette. **Be able to:** – to carry out business communication and conduct business conversations on professional topics; – prepare and transmit the necessary information in writing; – explain your point of view and critically evaluate the provisions put forward; – create your Master the skills: statements, essays, etc. – apply business etiquette in speech

			Master the skills:: – skills of expressing 1's thoughts and opinions in interpersonal and business communication in Russian; – professional terms and concepts; – professional text analysis; – information competence: the ability to work with a book, textbook, reference literature, dictionaries, find the necessary information.
2	Professionally oriented foreign language	Professional competencies	**Know:** – 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 the skills of dialogic speech of a general nature related to situations of everyday and professional communication; – develop listening skills (with a full understanding of what they heard); – develop and improve writing skills; – improve the skills of introductory, studying, viewing and searching reading. **Be able to:** – automate the technical skills of silent reading; – develop the skills of monologue (prepared) speech - the deployment of the thesis; – to master reversed reading aloud of the prepared message; – teach referencing skills. **Master the skills::** – complexity in solving practical, educational, educational and developmental goals (at the same time, practical goals act as leading 1s); – communicative orientation of the learning process.

2	Physics	Basic competencies	**Know:** – the essence of the basic ideas, laws, theories of classical and modern physics in their internal interconnection and integrity, the concept of physical laws, the limits of their applicability, which allows them to be effectively used in specific situations; – laws and models of mechanics, molecular physics, electricity and magnetism, thermodynamics and statistical physics; – fundamental phenomena in the field of physics. **Be able to:** – solve generalized typical problems from various fields of physics as the basis for solving professional problems; – assess the degree of reliability of the results of experimental andtheoretical research methods; – use the achievements of fundamental science for the successful study of general theoretical and special technical disciplines, the development of mathematical thinking and logic. **Master the skills:** – evaluating the degree of reliability of the results obtained using experimental or theoretical research methods; – conducting a physical experiment.
2	Digital circuitry	Basic competencies	**Know:** – general information about the element base of circuitry (resistors, capacitors, diodes, transistors, microcircuits, elements of ontoelectronics), functional units (decoders, encoders, multiplexers, demultiplexers, digital comparators, adders, triggers, registers, counters), storage devices for main LSI/ VLSI, logical elements and logical design in microcircuit bases, digital-to-analog and analog-to-digital converters. **Be able to:** – determine the parameters of semiconductor devices and elements of system engineering. **Master the skills:** – selection of types (family) of digital elements according to specified parameters; – design and simulation of circuit diagrams of digital devices; – work with software packages of virtual laboratories and real measuring instruments.

3	Electronics	Basic competencies	**Know:** – purpose, scope and physical principles of operation of the main electronic systems and devices; – the history of the development of electronics and modern microelectronics. **Be able to:** – use reference literature to select elements of electronic circuits, make the necessary calculations, draw up a mathematical description of the functioning of devices and determine their characteristics. **Master the skills**: – calculation and design of electronic devices, circuits and devices of various functional – appointments in accordance with the terms of reference and using design automation tools,measuring voltage on electronic circuits (using a digital voltmeter, oscilloscope, etc.); – use of materials and tools from the field of electronics in cases of simple maintenance, installation and repair work (hand tools, various soldering techniques)
3	Architecture and organization of computer systems	Professional competencies	**Know:** – about the concept of computer architecture, the principles of organizing multiprocessor and multicomputer systems, the direction of development of computers with traditional, parallel and non-traditional architecture, the reasons for building data transmission networks, the protocol and the level model for describing and implementing protocols. **Be able to:** – formulate technical requirements taking into account the functions performed by computing systems, and justify a rational architecture, determine the tools for the performance of computing systems, configure a computer to work on a local network and the Internet, create an address computer network. **Master the skills:** – choice of architecture and integration of modern computers, systems and networks; – system administrator.
Basic disciplines			
Selectable Comp1nt			
	Introduction to Blockchain	Professional competencies	**Know**: –the main concepts of blockchain, advantages and limitations of blockchain technologies; – key differences between blockchain and other technological systems; **Able to**: - understand the technical fundamentals of blockchain technology deeply enough to analyze the impact of certain implementation decisions in proposals; - understand relevant legal, ethical and confidential issues related to blockchain; **Possess skills**: –influence on the policies and actions of organizations or individuals; – identify real-world problems that blockchain technologies can help solve; or explain why they won't help.

	Fundamentals of Blockchain technology	Professional competencies	**Know:** – fundamentals of blockchain technology; – cryptographic fundamentals of blockchain technology on the platform .Net; – technologies for creating blockchain applications on the .Net platform **Able to**: - use blockchain technologies; - apply cryptographic fundamentals of blockchain technology on the platform .Net; - create blockchain applications on the .Net platform **Possess skills:** – skills in using blockchain technology; – skills of using cryptographic blockchain technologies on the platform .Net; – skills in creating blockchain applications on the .Net platform
	Theory of information processes	Professional competencies	**Know:** – fundamentals of information culture; principles and structure of information processes and systems; – assignment and classification of software tools for digital information processing; **Able to:** – to use IP theory, information processes and computer technology in solving specific practical problems; – to evaluate the problems of the relationship between the individual, human society and nature; – to identify the effect of physical laws in the processes and phenomena of nature; to develop proposals for the organization of information processes and systems when using the information space using modern technologies, digital assets; – choose network technologies and automated document management tools of the organization; **Possess skills**: – methods of organization and use of database management systems; methods of organization and evaluation of the effectiveness of the information space of the organization; – methods of working with application software

2	Information technologies	Professional competencies	**Know**: – basic concepts: information and information technology; – technologies for collecting, storing, transmitting, processing and providing information; – identification and authorization of users and network resources; – information security: the main types of threats, ways to counter threats **Able to:** – work with graphical operating systems of a personal computer (PC): enable, disable, manage sessions and tasks performed by the operating system of a personal computer; **Possess skills:** – presentation of information; – search for files, computers and network resources; – methods and means of determining the amount of information.
4	Theory of Probability and Mathematical Statistics	Professional competencies	**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 areas of human activity; **Master the skills:** – information about the main scientific achievements in the theory of probability and mathematical statistics;
	Discrete Math	Professional competencies	**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 areas of human activity; **Master the skills:** – information about the main scientific achievements in the theory of probability and mathematical statistics;

5	Programming languages and technologies	Professional competencies	**Know:** – programming methods and technologies; – basic data processing algorithms; – about modern programming languages; – on the structure of computing systems; **Be able to:** – develop algorithms; – implement algorithms in a high-level programming language; – implement methods of data analysis and processing; – work in programming environments. **Master the skills:***:* –methods and technologies for developing algorithms; –programming in a high-level language; – work in various programming environments
	Programming languages	Professional competencies	**Know:** – terminology of the discipline; – the main structures and tools that are used in programming languages, such as C ++: – basic structures and data types in C++; – basic methods in the development of algorithms (recursion, backtracking, branch and bound method, analysis of arithmetic expressions); – basic algorithms; – C++ dialects, including those used in programming microcontrollers; – libraries of standard programs. **Be able to:** – apply programming methods in the development of information systems; – determine data structures when designing algorithms in the process of solving problems; – break dMaster the skills: a complex problem into a series of simpler problems.
			Master the skills: – using the library of standard programs that are included in the C++ programming language; – independent mastering of the programming language that must be used in solving problems.
Major disciplines			
Required Comp1nt			

2	System Programming	Professional competencies	**Know:** – basic theoretical and practical skills of system programming at the level of program development, which allow obtaining modern programs with a complex logical structure at the lowest cost; – on the composition and principles of managing PC systems and networks; on the purpose of the comp1nts of the operating system; principles of functioning of various elements of operational systems of interaction; – generation and processing of processes in the system; – basic methods and principles of programming in modern operating systems; – basic concepts like: kernel objects, processes, threads, priorities, security attributes, heaps, semaphores. **Be able to:** – develop programs covering system software issues. **Master the skills:** – work with various operating systems and their administration; – procedural and object-oriented programming languages; – development and debugging of programs in at least 1 of the high-level algorithmic procedural programming languages.
3	Software development tools	Professional competencies	**Know:** – software system design technology; – the main directions in the field of design, development of software products and a set of tools that ensure their life cycle; – theoretical foundations for building instrumental software; – international and domestic standards used in the development of software products; – classical and modern approaches to building the interface and information structure of the toolkit. **Be able to:** – use the unified modeling language UML and use CASE tools (BPwin, Erwin, ARIS, Modelmart, Rational Rose, Microsoft Office Visio 2007) when designing software systems; – choose tools that provide the stages of the life cycle of programs; – develop and implement software products; – use standard constructions of software tools; analyze the characteristics, qualities and evaluation of the effectiveness of the use of tools; economic efficiency assessments; – implement a software tool; – implement a structural and object-oriented approach in working with the toolkit. **Master the skills:** – work on modern technologies for designing software systems (CASE-technologies).

			efficiency assessments; – implement a software tool; – implement a structural and object-oriented approach in working with the toolkit. **Master the skills:** – work on modern technologies for designing software systems (CASE-technologies).
3	Artificial Intelligence technology	Professional competencies	**Know**: – Basic concepts and methods of artificial intelligence (machine learning, neural networks, natural language processing, computer vision, etc.). – Mathematical foundations of AI (probability theory, statistics, linear algebra). – Modern tools and libraries for the development of AI systems (for example, TensorFlow, PyTorch, scikit-learn). – Ethical and legal aspects of the use of AI. **Be able to:** – Develop and implement AI algorithms to solve practical problems. – Analyze and optimize the operation of AI algorithms and models. – To test and validate AI models, evaluate their quality and interpretability. – Work with large amounts of data, scale solutions. **Master the skills**: – Programming skills in languages used in AI (for example, Python, R). – Practical experience in working with tools and libraries for the development of AI systems. – Methods of teamwork and project management in the context of AI product development. The ability to apply the acquired knowledge and skills to solve real-world problems in various fields

Major disciplines			
University comp1nt			
2	Basics of comp1nt technologies	Professional competencies	**Know:** – basic concepts of comp1nt programming technologies; – mechanisms for implementing comp1nt programming technologies in the VCL visual comp1nt library; – principles of event-oriented programming; ***Be able to:*** – analyze the subject area and select library classes necessary for solving applied problems; – use the tools of the C++ Builder integrated environment for visual development of applications. **Master the skills:** – development of application user interfaces based on universal and specialized comp1nts of the VCL library.
	Comp1nt technology and development	Professional competencies	**Know***:* – main types of distributed applications; – modern technologies for building and developing distributed applications; – main distributed object technologies and architectures (service-oriented architecture, comp1nt architecture, agent architecture, CORBA architecture). **Be able to:** – develop distributed applications using socket technologies, remote procedure calls, comp1nt models, CORBA, web services; – choose a development technology based on the specifics of the application. **Master the skills:** – development of distributed applications of various types; application of object-oriented programming in distributed systems.
	Information protection and information security	Professional competencies	**Know:** – the main subsystems of a computer, which cover such concepts as system highways, internal and external memory; – requirements for information security systems; – on the protection of corporate networks, the principles of ensuring the security of information processing systems; – main characteristics of cryptographic methods of information protection. **Be able to:** – in practice, use the means of protecting information from unauthorized access and destructive software effects. **Master the skills**: – access to electronic information resources, databases, as well as libraries, archives; – adaptation of information resources and information technologies; work with documents containing information

3	Data protection	Professional competencies	**Know***:* – main types of distributed applications; – modern technologies for building and developing distributed applications; – main distributed object technologies and architectures (service-oriented architecture, comp1nt architecture, agent architecture, CORBA architecture). **Be able to:** – develop distributed applications using socket technologies, remote procedure calls, comp1nt models, CORBA, web services; – choose a development technology based on the specifics of the application. **Master the skills:** – development of distributed applications of various types; application of object-oriented programming in distributed systems.

Table 3. List of modules for the educational program 6B06124 -" Computational technology and software »

№	Наименование модуля	Наименование дисциплины	Блок	Семестр	Кредит дисциплины	Форма контроля	Всего кредитов
M.1	Module of socio-political knowledge	Sociology	OOD/OK	2	8	Exam	8
		Political science				Exam	
		Culturology		1		Exam	
		Psychology				Exam	
M.2	Module of historical and philosophical knowledge	History of Kazakhstan	OOD/OK	2	5	SE	10
		Philosophy		4	5	Exam	
M.3	Economics and Ecology Module	Fundamentals of market economy and entrepreneurship	OOD/VK	2	3	Exam	5
		Fundamentals of safety and life and ecology			2	Exam	
M.4	Instrumental and communication module	Foreign language	OOD/OK	1,2	10	Exam	25
		Kazakh (Russian) language	OOD/OK	1,2	10	Exam	
		Information and communication technologies	OOD/OK	1	5	Exam	
M.5	Information technology	System programming	PD / VC	3	5	Exam	14
		Operating systems/Operating systems and shells	PD/ HF	5	5	Exam	
		Database design/ 1C programming	BD/CV	7	3	Exam	
		Educational practice	PD / VC	2	1	Diff credit	
M.6	Fundamentals of mathematics and computer modeling	Mathematics	BD/VK	1	4	Exam	14
		Probability Theory and Mathematical Statistics / DiscreteMathematics	DB /KV	2	3	Exam	
		Computer modeling/3D graphics and animation	BD/CV	7	5	Exam	
		Production practice 2	PD / VC	4	2	Diff credit	
M.7	Fundamentals of bilingual training	Professional Kazakh (Russian) language	DB/OK	4	3	Exam	6

		Professionally oriented foreign language	DB/OK	3	3	Exam	
M.8	Information processes and information security	Theory of information processes/Information Technologies	BD/CV	3	5	Exam	12
		Information security and information security / Information security	PD/ HF	5	5	Exam	
		Production practice 2	PD / VC	6	2	Diff credit	
M.9	Programming languages	Introduction to Programming	PD / VC	1	5	Exam	40
		Programming languages/ Programming languages and Technologies	BD/CV	5	5	Exam	
		Object-oriented programming in C++/ Functional programming	BD/CV	6	5	Exam	
		Fundamentals of component technologies/Component technologies and distributed software development	PD/ HF	6	5	Exam	
		Modern Java Programming Methods and Tools/ Modern NET Programming Methods and Tools	PD/ HF	7	3	Exam	
		PHP programming/Web programming	PD/ HF	7	5	Exam	
		Production practice 3	PD / VC	8	10	Diffn credit	
		Pre-graduate practice	PD / VC	8	2	Diff credit	
M.10	Architecture and configuration, repair of computer systems and networks	Setup, repair, optimization and maintenance of computer systems / Computer and communication systems engineering	BD/CV	3	5	Exam	20
		Architecture and organization of computer systems	DB/OK	5	5	Exam	
		Computer networks and telecommunications/Technology of computer and communication systems	PD/ HF	6	5	Exam	
		Distributed systems technologies/Technologies for the development of distributed information systems	PD/ HF	7	5	Exam	
M.11	Machine learning and artificial	Artificial intelligence technologies	PD / VC	6	5	Exam	17
		Internet of Things/Design of distributed	PD/CV	6	5	Exam	

	intelligence	control systems					
		Using data in machine learning/Introduction to Machine Learning and Data Analysis	PD / VC	7	3	Exam	
		Fundamentals of robotics and artificial intelligence/Robotic systems mini complexes	DB /KV	8	4	Exam	
M.12	Software development tools	Software development tools	BD/VK	4	5	Exam	11
		Software Development Technology/ Software Development Process	PD/CV	8	6	Exam	
M.13	Fundamentals of circuit design and microcontrollers	Physics	BD/VK	3	5	Exam	18
		Digital circuitry	BD/CV	4	5	Exam	
		Electronics	BD/CV	5	5	Exam	
		Microcontrollers and microprocessor systems/Fundamentals of microprocessor technology	PD/ HF	5	3	Exam	
M.14	Fundamentals of Blockchain Technology and Programming No Code/Low Code	Introduction to the Blockchain/The basics of blockchain technology	BD / HF	3	5	Exam	24
		Decentralized applications/ LMS technologies	BD / HF	4	3	Exam	
		Programming No Code/Lo Code/Object-oriented programming	BD/CV	4	5	Exam	
		Introduction to Web 3/ Introduction to Internet Marketing	PD/ HF	4	2	Exam	
		Smart Contract Architecture/ Working with Ethereum	PD/ HF	6	3	Exam	
		Architecture of the blockchain system / Development Environment Ethereum, Web3 and Truffle	BD / HF	7	3	Exam	
		Blockchain Business Models/ The basics of blockchain and cryptocurrencies	PD/ HF	7	3	Exam	
M.15	Health Promotion Module	Physical Culture	OK OOD	1-4	8	Diff credit	8
M.16	Final certification	Final certification	DVO	8	8	FC	8