

ALIKHAN BOKEIKHAN UNIVERSITY

MODULAR EDUCATIONAL PROGRAM
6B06124 " Computational technology and software "

Semey, 2022

Developed by the Department of Information and Technical Sciences

Discussed and approved at a meeting of the Department of Information and Technical Sciences
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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 October 12, 2018 No. 563;
- 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 "System and network administration", "Software development", "Information security" approved by order №222 of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 05, 2022;

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) - 72 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) - 18 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 228 credits of theoretical training and 12 - final certification. The MOS consists of 22 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 18, 2022)

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

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

Duisenbayeva A.K. - Head of the Competence Center "Radio Engineering, Electronics and Telecommunications" on the basis of the NGO VKO "College of Radio Engineering and Communications", head and instructor of "Cisco Networking Academy",

Nugumanov G.T. - senior IT specialist of the State Enterprise "Medical College named after D. Kalmataev",

Kanapin T.K. - programmer of the automated control system department, GКУ Semey Vodokanal,

Zhubanov T. - Java developer, medware Atlanta GA.

The purpose of the modular educational programs - training of specialists who are competitive in the labor market and have the skills to install, configure and maintain system, instrumental and applied software, computers and computer systems, who have programming languages such as Pascal, PHP, MATLAB, C ++, Delphi, Java, JavaScript, Python.

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

ON 1 Analyze the basic theoretical and practical skills of system programming and operating systems at the level of program development, develop documentation for the artificial intelligence system and its parts and robotics.

ON2 Evaluate the effectiveness of the applied hardware and software for providing information security, apply the main models and means of information transfer to optimize modern computer systems

ON 3 Change the configuration, understand the client's requests and implement them in the 1C program.

ON 4 Formulate technical requirements taking into account the functions performed by computing systems and justify a rational architecture, define tools for the performance of computing systems, monitor technological operations carried out by IoT devices to increase the predictability of their operation, create computer network addressing, diagnose and restore performance computer systems and complexes.

ON 5 Have a detailed knowledge of basic programming procedures and functions, PC and its main technical characteristics and functionality; professional problems in the field of computer technology and telecommunications.

ON 6 Evaluate proposed solutions to improve business processes and/or ICT projects of the organization

ON 7 Associate the stages of solving a problem on a computer, data types; basic constructions of the studied programming language Python; principles of structured and modular programming; principles of object-oriented programming.

ON 8 Demonstrate knowledge of the documentation requirements adopted in professional communication, understanding of oral speech within professional topics, select the necessary information from various sources.

ON 9 Formulate systematic knowledge of modern programming languages, methods and tools of software development, analyze tasks in programming languages, set up development tools, conduct software code reviews, develop various types of requirements for software

ON 10 Have a good understanding of mathematics, statistics, mathematical models in problem solving, numerical methods and problem solving algorithms.

ON 11 Analyze general information about the element base of circuitry, functional units, calculation and design of electronic devices, circuits and devices for various functional purposes in accordance with the terms of reference and using design automation tools, the principles of building microprocessor systems, the program logic model of microcontrollers.

ON 12 Use modern computer technology for process modeling

ON 13 Apply machine learning methods to solve applied problems, apply mathematical modeling methods to research and design distributed systems.

ON 14- Describe the mechanisms for implementing computer programming technologies in a visual computer library in the VCL.

To create special conditions for people with special educational needs to receive education, the competence model of a graduate is complemented by professional competencies that ensure the adaptive nature of the main educational program. To this end, the catalog of courses of the additional educational program "Minor" includes courses for the formation of persons with special educational needs of the ability to successfully socialize in society and actively adapt to the labor market, taking into account the characteristics of the disease.

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 worldview, 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, focusing on a healthy lifestyle, self-improvement and professional success;
- form a system of general competencies that ensure the socio-cultural development of the personality of a future specialist on the basis of the formation of his worldview, civic and moral positions;
- develop abilities for interpersonal social and professional communication in Kazakh, Russian and foreign languages;
- contribute to the development of information literacy through the mastery and use of modern information and communication technologies in all areas of their lives and activities;
- form the skills of self-development and education throughout life;
- form a personality capable of mobility in the modern world, critical thinking and physical self-improvement;
- evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the foundations of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge, reveal the meaning of the content and specific features of the mythological-religious and scientific worldview;
- show a civil position based on a deep understanding and scientific analysis of the main stages, patterns, originality of the historical development of Kazakhstan, use methods, techniques of historical description to analyze the causes and consequences of events in the history of Kazakhstan;
- assess situations in various areas of interpersonal, social and professional communication, taking into account the basic knowledge of sociology, political science, cultural studies, psychology, arguing 1's Master the skills: assessment of everything that happens in the social and industrial spheres, as well as synthesize knowledge of these sciences as a modern product of integrative processes;
- use scientific methods, techniques for researching a particular science, as well as the entire socio-political cluster, select a methodology, analysis and generalize the results of the study;
- develop their Master the skills: moral and civic position on the basis of public, business, cultural, legal and ethical norms of Kazakhstani society;
- apply in 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;
- engage in oral and written communication in Kazakh, Russian and foreign languages, using language and speech means based on grammatical knowledge to solve problems of interpersonal, intercultural and industrial (professional) communication, as well as analyze information, actions and deeds of communication participants in accordance with the situation of communication;
- use various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services for searching, storing, processing, protecting and disseminating information;

- build a personal educational trajectory throughout life for self-development and career growth, focus on a healthy lifestyle to ensure full-fledged social and professional activities through the methods and means of physical culture;
- know and understand the basic patterns of the history of Kazakhstan, the foundations 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, master the skills of quantitative and qualitative analysis of social phenomena, processes and problems.

Basic competencies:

- use the fundamental concepts of mathematics in professional activities;
- carry out the proof of mathematical statements, solve mathematical problems and problems, reveal their essence, translate into mathematical language the problems posed in terms of other subject areas, in particular it-technologies;
- set mathematical problems; build mathematical models;
- select appropriate mathematical methods and algorithms for solving problems;
- conduct high-quality mathematical research.
- apply the basic methods of formalizing reasoning, the basic concepts of the theory of logical functions, the theory of algorithms, graph theory, coding theory;
- use the conceptual apparatus and methods of discrete mathematics to analyze 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 elements of electronic circuits, make the necessary calculations, draw up a mathematical description of the functioning of devices and determine their characteristics;
- determine the parameters of semiconductor devices and circuitry elements, use methods for constructing various models of data types, information processing algorithms;

Professional competencies:

- identify potential threats and dangers, apply methods and means of ensuring 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 with functions, performed computing systems;
- define tools for evaluating system performance;
- use unified modeling language, install architectures and key points of distributed client-server applications;
- apply technologies of network interaction of communication systems, create applications of network interaction of means, implement a structural

and approach in working with tools;

- apply the basic methods of mathematical analysis and modeling, theoretical and experimental research;
- Master the skills: mathematical apparatus in solving professional problems;
- compress and archive information;
- use general purpose applications;
- rationally use the opportunities provided by the algorithmization technique for solving practical problems;
- formulate technical requirements taking into account the functions performed by computer systems;
- define tools for evaluating system performance;
- have an idea about the features of artificial intelligence tasks and the role of logical 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 activities;
- to develop the ability to transmit scientific information and literature of a socio-political nature.

Special competencies:

- to program in modern algorithmic languages, to understand the fundamental principles of software construction;
- Master the skills: different approaches in programming methodology, know paradigms
- modular and object-oriented programming.
- use unified modeling language, install architectures and key points of distributed client-server applications;
- apply technologies of network interaction of communication systems, create applications of network interaction of means, implement a structural and object-oriented approach in working with tools;
- perform typical design tasks, deployment and technical maintenance of local and global networks; administer networks in modern operating systems
- establish architectures and key points of distributed client-server applications, apply networking technologies for communication systems, create networking applications;
- be able to apply the general principles of creating distributed systems; Master the skills: 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, styling principles - CSS, document model processing mechanisms;
- develop web scripts, programming in PHP, JavaScript

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

N o.	Competencies	The list of compulsory, elective disciplines and the sequence of their study		Expected results
		List of disciplines	The sequence of their study (sem.)	
1	Special competencies	Object Oriented Programming in Delphi/	4	<p>Know:</p> <ul style="list-style-type: none"> – the basics of algorithmization and the principles of constructing an algorithm .; – concept of programming.; – classification of programming languages; – problem solving algorithms; – methods and important ways of constructing algorithms. <p>Be able to:</p> <ul style="list-style-type: none"> – object-oriented design; – develop programs in an object-oriented programming environment; – apply object-oriented programming languages to solve problems in the subject area; – create application packages. <p>Master the skills:</p> <ul style="list-style-type: none"> – object-oriented programming languages; – algorithmization and work in the programming environment; – fundamentals of object-oriented design and analysis.
		Object Oriented Programming	4	<p>Know:</p> <ul style="list-style-type: none"> – what is class and object; – basic principles of object-oriented programming; – principles of building classes; – criteria for checking the correctness of building classes; – main trends in the development of object-oriented programming technologies; <p>Be able to:</p> <ul style="list-style-type: none"> –use modern methods of object-oriented programming when coding software systems of different levels of complexity; <p>Master the skills:</p> <ul style="list-style-type: none"> –work with visual programming environment Delphi;

				– basics of algorithmization
2	Special competencies	Operating Systems/	5	<p>Know:</p> <ul style="list-style-type: none"> – concept, construction principles, types and functions of operating systems; – operating environment; – machine-independent properties of operating systems. <p>Be able to:</p> <ul style="list-style-type: none"> – install and maintain operating systems; – take into account the features of work in a particular operating system, organize support for applications of other operating systems; – use operating system tools. <p>Master the skills:</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – the current state of the level and directions of development of computer technology and software; – main stages, methods, means and standards of software development; – main types of operating systems, principles of resource management in the operating system; – features of work in specific operating environments and shells; – service software; – ways of organizing, storing and processing information on a computer. <p>Be able to:</p> <ul style="list-style-type: none"> – work in the chosen environment; – learn a new operating system or software shell; – receive information about users, processes, directories, help about system commands; – exchange messages with other users; – create and view directories, copy, move and delete files, manage file access mode; – create, view and merge text files, search by pattern, search for files by specified properties, use pipelines and I/O redirection. <p>Master the skills:</p>

				<ul style="list-style-type: none"> – security and fault tolerance of operating systems; – principles of building operating systems and shells; – ways to organize device support, hardware drivers, network operating systems.
3	Special competencies	Microcontrollers and microprocessor systems	5	<p>Know:</p> <ul style="list-style-type: none"> – program logic model of microprocessor 1810VM86; – modes of operation of the microprocessor 1810 BM86; – principles of construction of microprocessor systems; – program logic model of 1816 series microcontrollers; – operating modes of microcomputer 1816 BE48; <p>Be able to:</p> <ul style="list-style-type: none"> – build microprocessor systems based on 1816 and 1810 kits; – test microprocessors in computers; <p>Master the skills:</p> <ul style="list-style-type: none"> – drawing up electronic circuits for the operation of microprocessors and methods of switching on
		Fundamentals of microprocessor technology	5	<p>Know:</p> <ul style="list-style-type: none"> – principles of building 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, performance characteristics and scope of application of the main devices and functional units of electronics, and MPS; – basic principles of designing circuits based on MPS. <p>Be able to:</p> <ul style="list-style-type: none"> – carry out the design and calculation of typical units of the MPS; – select the MPS for the required task. <p>Master the skills:</p> <ul style="list-style-type: none"> – analysis and synthesis of electronic circuits with MPS; – design and calculation of electronic devices using computers.
4	Special competencies	Computer networks and telecommunications	6	<p>Know:</p> <ul style="list-style-type: none"> – main network components, types of communication lines – types of IP addresses – network protection methods and means – PHP syntax – SQL syntax – domain types and hosting types.

				<p>Be able to:</p> <ul style="list-style-type: none"> – create LAN schemes – clean PC from viruses – apply EDS – apply encryption principles – create PHP applications – create database websites – create a database using phpmyadmin and SQL – process form data <p>Master the skills:</p> <ul style="list-style-type: none"> – creating a LAN scheme – configure and administer the network – creating applications in PHP – creating and maintaining websites – publishing websites on the Internet – system and network administration
		Computer and communication systems engineering	6	<p>Know:</p> <ul style="list-style-type: none"> – features of control and diagnostics of devices of hardware-software systems; – basic diagnostic methods; – use of service tools and built-in test programs; – hardware and software configuration of computer systems and complexes; <p>Be able to:</p> <ul style="list-style-type: none"> – monitor, diagnose and restore the performance of computer and communication systems; – perform computer system maintenance and communication systems; <p>Master the skills:</p> <ul style="list-style-type: none"> – monitoring, diagnostics and restoration of working capacity computer and communication systems; – system maintenance computer and communication systems;
5	Special competencies	Object-Oriented Programming in C++	6	<p>Know:</p> <ul style="list-style-type: none"> – the concept of object-oriented programming, its basic concepts (class, object), properties (encapsulation, inheritance, polymorphism); – methods of analysis and design of object-oriented programs; – basic concepts, syntax and semantics of C++ programming language constructs;

				<ul style="list-style-type: none"> – ways of compiling object-oriented programs in the C++ programming language; – capabilities of the integrated programming environment in C++. <p>Be able to:</p> <ul style="list-style-type: none"> – debug and test programs written in C++; – formulate a statement of tasks; perform a formalized description of the task, its algorithmization; – based on the existing algorithm, build a computer program in algorithmic languages and C ++. <p>Master the skills:</p> <ul style="list-style-type: none"> – on object-oriented design; – development of object-oriented program code in modern operating systems.
		Functional programming	6	<p>Know:</p> <ul style="list-style-type: none"> – features of artificial intelligence problems and the role of functional programming as methodologies for solving these problems; – trends and prospects for the development of functional programming tools; – fundamentals of the theory and practice of lambda - calculus. <p>Be able to:</p> <ul style="list-style-type: none"> – develop software applications for solving tasks in a functional programming language; – develop algorithms for solving problems for functional programming <p>Master the skills:</p> <ul style="list-style-type: none"> – work with software applications to solve tasks in a functional programming language; – development of algorithms for solving problems for functional programming
6	Special competencies	Setup, repair, optimization and maintenance of computer systems	6	<p>Know:</p> <ul style="list-style-type: none"> – features of control and diagnostics of devices of hardware-software systems; – basic diagnostic methods; – hardware and software for functional control and diagnostics of computer systems and complexes; capabilities and areas of application of standard and special control and measuring equipment for localization of fault points of SVT; – use 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 stable operation of computer systems and complexes. <p>Be able to:</p>

			<ul style="list-style-type: none"> – to carry out control, diagnostics and restoration of 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – monitoring, diagnostics and recovery of computer systems and complexes; – system maintenance of computer systems and complexes; – debugging of hardware-software systems and complexes; – installation, configuration and configuration of the operating system, drivers, resident programs
	Maintenance and repair of computer systems and complexes	6	<p>Know:</p> <ul style="list-style-type: none"> – features of control and diagnostics of devices of hardware-software systems; – basic diagnostic methods; – hardware and software for functional control and diagnostics of computer systems and complexes, the possibilities and scope of standard and special control and measuring equipment for localizing the fault points of SVT; – use 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, methods for ensuring the stable operation of computer systems and complexes; – rules and regulations of labor protection, safety, industrial sanitation and fire protection. <p>Be able to:</p> <ul style="list-style-type: none"> – to carry out control, diagnostics and restoration of 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; – comply with safety regulations;

				Master the skills: – monitoring, diagnostics and recovery of computer systems and complexes;
7	Special competencies	Artificial intelligence systems	6	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 components of the operating system; principles of functioning of various elements of operational systems of interaction; – generation and processing of processes in the system; 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, skills in developing and debugging programs in at least 1 of the high-level algorithmic procedural programming languages.
		Intelligent Animation	6	Know: – history of artificial intelligence. – about applied systems of artificial intelligence. – types of animation. Be able to: – navigate in various types of intelligent systems; – navigate in various methods of knowledge representation, move from 1 method to another; Master the skills: – development of production knowledge bases for solving problems of the problem of choosing options in a poorly formalized subject area; application of the main models of neural networks

8	Special competencies	Business software	6	<p>Know:</p> <ul style="list-style-type: none"> – basic concepts of automated information processing in business processes; – general composition and structure of personal computers and computing systems; – composition, functions and possibilities of using information and telecommunication technologies in business; – methods and means of collecting, processing, storing, transmitting and accumulating information; <p>Be able to:</p> <ul style="list-style-type: none"> – use technologies for collecting, placing, storing, accumulating, converting and transmitting data in professionally oriented information systems; – use in professional activities various types of software, including special; – use computer and telecommunication means; <p>Master the skills:</p> <ul style="list-style-type: none"> – technologies for collecting, placing, storing, accumulating, converting and transmitting data in professionally oriented information systems; – use of methods, techniques, tools for creating an Internet company; – planning and evaluating the results of business activities in the Internet sphere
		Fundamentals of Internet Entrepreneurship	6	<p>Know:</p> <ul style="list-style-type: none"> – practice of organizing the work of an enterprise in the Internet sphere; – the specifics of consumer behavior and marketing aspects of Internet entrepreneurship; – market research and analysis tools; – the main business models of companies operating in the Internet sphere. <p>Be able to:</p> <ul style="list-style-type: none"> – conduct business activities in companies of high-tech sectors; – develop and implement business models. <p>Master the skills:</p> <ul style="list-style-type: none"> – use of methods, techniques, tools for creating an Internet company; – planning and evaluating the results of entrepreneurial activity in the Internet sphere.
9	Special competencies	Internet of Things	6	<p>Know:</p> <ul style="list-style-type: none"> – principles of organization and functioning of the "Internet of Things" – the history of the emergence and development of the "Internet of things"

			<ul style="list-style-type: none"> – the main factors in the development of the "Internet of things" – existing technologies in the Internet of Things industry – the main trends and directions in the field of "Internet of things". <p>Be able to:</p> <ul style="list-style-type: none"> – work with microcontrollers and basic repair plates (Arduino and Raspberry Pi) – understand existing IoT technologies and their application to specific scenarios – design of complete IoT systems (including end devices, network connections, data exchange, cloud platforms, data analysis). <p>Master the skills:</p> <ul style="list-style-type: none"> – terminological apparatus; – end device programming – for connecting end devices to the network – to develop a software solution for data processing and storage.
	Design of distributed control systems	6	<p>Know:</p> <ul style="list-style-type: none"> – properties, characteristics and architectures (structures and topologies) of distributed control and automation systems (DCS), – types of support {methodological, technical, software, information, metrological, ergonomic and organizational and legal}; – functional tasks and criterion of DCS efficiency; <p>Be able to:</p> <ul style="list-style-type: none"> – carry out projects of automation equipment, automation systems for technological processes: – perform automation of scientific research and testing: – design and implement algorithms for pre-processing information (compression, filtering, improving the accuracy of conversion, etc.), – build modern control algorithms – determine the network section with the maximum delay in the transmission of IP packets; – generate HTTP requests and parse HTTP response fields; – develop hypertext documents. <p>Master the skills:</p> <ul style="list-style-type: none"> – performing formal construction and transformation of analytical and simulation models

				<p>of DCS;</p> <ul style="list-style-type: none"> – 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
te n	Special competencies	IC programming	7	<p>Know:</p> <ul style="list-style-type: none"> – principles of building automatic machine systems and fundamental theories of automation of production processes; – features of automation of assembly processes; – target mechanisms of automatic machines and automatic lines; <p>Be able to:</p> <ul style="list-style-type: none"> – design separate target mechanisms of automatic machines and automatic lines; – design automatic machine systems; – perform performance and reliability calculations of automatic equipment; <p>Master the skills:</p> <ul style="list-style-type: none"> – analysis of productivity, reliability and economic efficiency of automatic lines; – on processing and analysis of statistical information on reliability, performance and improving the efficiency of operation of automatic systems
		Database design	7	<p>Know:</p> <ul style="list-style-type: none"> – features of the relational model and their impact on database design, visual tools used in ER-modeling; – fundamentals of relational algebra; database design principles, ensuring data consistency and integrity; database structure design tools; – SQL query language. <p>Be able to:</p> <ul style="list-style-type: none"> – design a relational database; – use the SQL language to programmatically extract information from databases. <p>Master the skills:</p> <ul style="list-style-type: none"> – searching and structuring information; – modern methods and technologies for the development and support of technical

				systems.
el ev en	Special competencies	Computer modelling	7	<p>Know:</p> <ul style="list-style-type: none"> – basic concepts of modeling theory, classification of models and areas of their use, modeling tasks; – the main modeling tools used in the system design process at different stages of project detailing; – methods of modeling and analysis of systems; – principles of building models. <p>Be able to:</p> <ul style="list-style-type: none"> – perform analysis of the system or process under study; reasonable choice of modeling method; – build an adequate model of a system or process using modern computer tools; – interpret and analyze simulation results. <p>Master the skills:</p> <ul style="list-style-type: none"> – the main criterion for evaluating the obtained simulation results; – experience and use in the course of modeling scientific and technical information
		Mathematical and computer modeling	7	<p>Know:</p> <ul style="list-style-type: none"> – methods for solving basic mathematical problems - integration, - differentiation, solving linear and transcendental equations and systems of equations using a computer; – basic principles for constructing mathematical models; – main types of mathematical models. <p>Be able to:</p> <ul style="list-style-type: none"> – use basic numerical methods for solving mathematical problems; – develop algorithms and programs for solving computational problems, taking into account the necessary accuracy of the result; – select analytical methods for studying mathematical models; – use numerical methods for studying mathematical models. <p>Master the skills:</p> <ul style="list-style-type: none"> – solving computational problems with the help of computer simulation.
12	Special competencies	Modern Java Programming Methods and Tools	7	<p>Know:</p> <ul style="list-style-type: none"> – types, data characteristics, operations, language operators; – principles of object-oriented programming; – fundamentals of computer networks and networking, internet services, concepts, Java

				<p>programming environment.</p> <p>Be able to:</p> <ul style="list-style-type: none"> – use classes to handle applications; – work with files; use the principles of building a graphical interface, graphical primitives; convert applets. <p>Master the skills:</p> <ul style="list-style-type: none"> – work with operators, with application processing arrays; – creating classes, class methods, publishing objects; – creating client comp lnts and applications; – working with Java network technologies.
		Modern NET Programming Methods and Tools	7	<p>Know:</p> <ul style="list-style-type: none"> – types, data characteristics, operations, language operators; – principles of object-oriented programming; – basics of computer networks and network associations, internet services, concepts, NET programming environment. <p>Be able to:</p> <ul style="list-style-type: none"> – use classes to handle applications; – work with files; use the principles of building a graphical interface, graphical primitives; – convert applets. <p>Master the skills:</p> <ul style="list-style-type: none"> – work with operators, with application processing arrays; – creating classes, class methods, publishing objects; – creating client comp lnts and applications; work with NET network technologies.
13	Special competencies	Using Data in Machine Learning	7	<p>Know:</p> <ul style="list-style-type: none"> – principles of constructing feature vectors, decision rules and classification; – main types of classifiers; – principles of construction of linear classifiers; <p>Be able to:</p> <ul style="list-style-type: none"> – choose the appropriate type of classifier depending on the problem being solved; – select feature sets for classification and preprocessing data; – use learning algorithms and compiling a classifier for selection;

				<p>Master the skills:</p> <ul style="list-style-type: none"> – selection, creation, training and use of basic classifiers problem solving.
		Introduction to Machine Learning and Data Analysis	7	<p>Know:</p> <ul style="list-style-type: none"> – main ways of data transformation; – the main stages of a machine learning project <p>Be able to:</p> <ul style="list-style-type: none"> – work with arrays – formulate business tasks as machine learning tasks – find a solution to machine learning problems in specific business tasks <p>Master the skills:</p> <ul style="list-style-type: none"> – loading, transforming, cleaning and visualizing data in Python – applying machine learning models in Python – quality assessments and interpretation of the results
4t ee n	Special competencies	3D graphics and animation	7	<p>Know:</p> <ul style="list-style-type: none"> – basic concepts of three-dimensional graphics; – main features of the 3D Studio MAX program; <p>Be able to:</p> <ul style="list-style-type: none"> – create a motionless 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; <p>Master the skills:</p> <ul style="list-style-type: none"> – creating 3D graphics in 3D Studio MAX, Autodesk 3ds Max and Autodesk Maya 3d. – development of graphic and multimedia design
		Interactive graphics systems	7	<p>Know:</p> <ul style="list-style-type: none"> – about the basics of two-dimensional, three-dimensional graphics, operations with graphic objects. <p>Be able to:</p> <ul style="list-style-type: none"> – practical use of computer graphics in the design of products and equipment for technological processes; – perform operations with graphic objects. <p>Master the skills:</p> <ul style="list-style-type: none"> – basic techniques for creating, converting and editing multimedia data; – combining multimedia information into a single information field;

fif te en	Special competencies	PHP Programming	7	<p>Know:</p> <ul style="list-style-type: none"> – assignments, functions, classification of PHP programming, – principles of Internet services; – principles of organization and operation of web information processing technologies and the Internet <p>Be able to:</p> <ul style="list-style-type: none"> – create static and dynamic pages. – create a concept proposal in WEB pages using technologies to create a site and publish it on the Internet <p>Master the skills:</p> <ul style="list-style-type: none"> – programming and client-server technologies.
		Web programming	7	<p>Know:</p> <ul style="list-style-type: none"> – technologies for developing static websites; – techniques for using multimedia (graphics, videos, animations) on web pages; – client-side software used to create web pages; <p>Be able to:</p> <ul style="list-style-type: none"> – design and develop the site structure; – use HTML hypertext markup language and cascading style sheets (CSS) to create web pages; – develop scripts in the JavaScript programming language; <p>Master the skills:</p> <ul style="list-style-type: none"> – creation of websites;
16	Special competencies	Distributed Systems Technologies	7	<p>Know:</p> <ul style="list-style-type: none"> – principles of building distributed information processing systems; – database distribution principles; – technology and models of the client-server network; – object data binding technologies. <p>Be able to:</p> <ul style="list-style-type: none"> – use technologies for building and operating distributed information systems. <p>Master the skills:</p> <ul style="list-style-type: none"> – work with modern systems for the design and development of distributed systems.
		Technologies for the development of distributed	7	<p>Know:</p> <ul style="list-style-type: none"> – principles of building distributed information processing systems;

		information systems		<ul style="list-style-type: none"> – communication in distributed systems; – types of links; – transaction concept <p>Be able to:</p> <ul style="list-style-type: none"> – use technologies for building and operating distributed information systems. <p>Master the skills:</p> <ul style="list-style-type: none"> – work with modern systems for the design and development of distributed systems
17	Special competencies	Fundamentals of Robotics and Artificial Intelligence	8	<p>Know:</p> <ul style="list-style-type: none"> – mathematical models of systems for automation and robotization of production processes using modern software data products; <p>Be able to:</p> <ul style="list-style-type: none"> – design automation and robotization systems; comparative analysis using modern software products for robotization of technological complexes and automation systems for production processes in various industries, as well as artificial intelligence methods; <p>Master the skills:</p> <ul style="list-style-type: none"> – formation of modern trends in the development of robotization systems and automation of production processes
		Robotic systems and complexes	8	<p>Know:</p> <ul style="list-style-type: none"> – control systems for industrial robots; – about remote-controlled robots; <p>Be able to:</p> <ul style="list-style-type: none"> – solve programming problems using robotic systems <p>Master the skills:</p> <ul style="list-style-type: none"> – 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
8e en	Special competencies	Software development technology	8	<p>Know:</p> <ul style="list-style-type: none"> – current trends in the development of informatics and computer technology, computer technology; – the basics of creating information systems and the use of new information technologies for information processing; <p>Be able to:</p> <ul style="list-style-type: none"> – apply mathematical methods, physical laws and computer technology to solve practical

				<p>problems;</p> <ul style="list-style-type: none"> – program in 1 of the algorithmic languages; – apply information search algorithms in software development; – choose tools when creating software; – apply software building standards; <p>Master the skills:</p> <ul style="list-style-type: none"> – drawing up projects for the development of modern software; – technologies for collecting, processing, transmitting and storing information: – software development; – comparative analysis of the choice of tools.
		Software development process	8	<p>Know:</p> <ul style="list-style-type: none"> – theoretical foundations of instrumental software; – classical and modern methods of building information structure and tool interface. <p>Be able to:</p> <ul style="list-style-type: none"> – choose tools when creating software; – apply software building standards; – evaluate the effectiveness of the toolkit and analyze the qualitative characteristics; – realize the economic efficiency of the software; – apply object-oriented and structured distribution methods in instrumentation. <p>Master the skills:</p> <ul style="list-style-type: none"> – software development; – comparative analysis of the choice of tools.

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

Well	Supporting disciplines	Competencies	Expected Result
General education disciplines			
Required CompInt			
1	History of Kazakhstan	Competencies general education	<p>Know:</p> <ul style="list-style-type: none"> – demonstrate knowledge and understanding of the main stages in the development of the history of Kazakhstan; <p>Be able to:</p> <ul style="list-style-type: none"> – correlate the phenomena and events of the historical past with the general paradigm of the world-historical

			<p>development of human society through critical analysis;</p> <ul style="list-style-type: none"> – objectively and comprehensively comprehend the immanent features of the modern Kazakh model of development; <p>Master the skills::</p> <ul style="list-style-type: none"> – 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 (in English)	Competences of general education	<p>Know:</p> <ul style="list-style-type: none"> – what economic and political factors contributed to the development of information and communication technologies; – features of various operating systems, architecture; <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – database structure development; – designing and creating presentations; – receiving data from the server; – creating video files; – work with Smart-applications; – work with services on the e-government website.
1.2	Foreign language	Competencies general education	<p>Know:</p> <ul style="list-style-type: none"> – lexical minimum and language material of topics and subtopics in a given discipline (social and social and cultural spheres of communication). <p>Be able to:</p> <ul style="list-style-type: none"> – understand by ear not only individual phrases and frequently used words, but also more voluminous statements on topics directly related to him,

			<ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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.
1	Kazakh (Russian) language	Competencies general education	<p>Know:</p> <ul style="list-style-type: none"> – 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, components of a speech situation, speaker's intentions. <p>Be able to:</p> <ul style="list-style-type: none"> – 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;

			<ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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; <p>Be able to:</p> <ul style="list-style-type: none"> – 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 <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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 <p>Be able to:</p>

			<ul style="list-style-type: none"> – 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 <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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

			<p>concepts, various interpretations of culture and civilization in world and domestic literature;</p> <ul style="list-style-type: none"> – 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 <p>Be able to:</p> <ul style="list-style-type: none"> – 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; <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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 Market Economy and Entrepreneurship/	Competencies general education	<p>Know:</p> <ul style="list-style-type: none"> – various scientific theories about the market economy, entrepreneurial activity, consideration of types, areas of entrepreneurial activity, market mechanism. – various quantitative methods of business calculations, marketing research, analytical calculations and forecasts, Master the skills:s the methodology for calculating general and actual indicators of production and business projects; <p>Be able to:</p> <ul style="list-style-type: none"> – analyze and justify the reality of business plans, market segmentation, competently and professionally assess market conditions for organizing your business, creatively approach the solution of various economic problems; – analyze the economic situation in the sphere of entrepreneurship and give a correct assessment of qualitative changes in the development of the economy; – to possess practical skills of independent conduct of economic work at the enterprise, quick and correct
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			<p>orientation to the initial information and calculated economic indicators.</p> <p>Master the skills::</p> <ul style="list-style-type: none"> – fundamentals of a market economy and entrepreneurship; – basic teachings, concepts and directions for the development of a market economy and entrepreneurship; – methods for constructing graphs and diagrams illustrating various economic models, and types of business plans; directions of evaluation of economic processes and phenomena; – topical problems of the modern economy, ways to identify problems of an economic nature in the analysis of specific situations, micro-methods and Master the skills:s methods for solving them, taking into account the actions of economic laws at macro levels.
1	Fundamentals of safety and life and ecology	Competencies general education	<p>Know:</p> <ul style="list-style-type: none"> – the legislative framework for life safety and environmental control, as well as methods for identifying, eliminating the influence of harmful factors on humans and the environment, and providing comfortable conditions for human life and activities; <p>Be able to:</p> <ul style="list-style-type: none"> – systematize safety standards for use in professional activities; – choose methods of protection against dangers in relation to the scope of their professional activities and choose ways to ensure comfortable living conditions; <p>Master the skills</p> <ul style="list-style-type: none"> – ensuring life safety in industrial, living conditions and in emergency situations, first aid skills.
Basic disciplines			
University complnt			
1	Algorithmization and programming	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – features, basic algorithms and their implementation in the chosen programming language (the most preferred are Python, C, Java); – internal data structure <p>Be able to:</p> <ul style="list-style-type: none"> – use the most common data structures – build drawings of various parts and objects in the specialty <p>Master the skills:</p> <ul style="list-style-type: none"> – 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.
1	Maths	Basic	Know:

		competencies	<ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – build mathematical models; – set mathematical problems; – select appropriate mathematical methods and algorithms for solving the problem; – conduct high-quality mathematical research. <p>Master the skills:</p> <ul style="list-style-type: none"> – elements of analytical geometry, linear algebra, solving professional problems;
2	Professional Kazakh (Russian) language	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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 <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – lexical material on the topics of this discipline; – regulatory requirements for registration (official letter, essay, etc.). – improve pronunciation skills;

			<ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills::</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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 and theoretical 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – evaluating the degree of reliability of the results obtained using experimental or theoretical research methods; – conducting a physical experiment.
2	Digital circuitry	Basic competencies	<p>Know:</p> <ul style="list-style-type: none"> – general information about the element base of circuitry (resistors, capacitors, diodes, transistors, microcircuits, elements of onoelectronics), functional units (decoders, encoders, multiplexers, demultiplexers, digital

			<p>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.</p> <p>Be able to:</p> <ul style="list-style-type: none"> – determine the parameters of semiconductor devices and elements of system engineering. <p>Master the skills:</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – purpose, scope and physical principles of operation of the main electronic systems and devices; – the history of the development of electronics and modern microelectronics. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – choice of architecture and integration of modern computers, systems and networks; – system administrator.
Basic disciplines			
Selectable Comp1nt			

1	Introduction to the specialty	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – the volume and level of requirements for bachelors in the specialty "Computer Engineering and Software", the content of the entire curriculum for the period of study; – the physical basis of the functioning of the PC, its main technical characteristics and functionality; – general characteristics of the specialty, area, objects, types of professional activity, tasks of design, research, organizational, managerial and operational activities; – features of various operating systems, architecture. <p>Be able to:</p> <ul style="list-style-type: none"> – pose, formulate the problems of technical projects to fulfill the tasks of programming and technical solutions in the professional field; – identify problems of a technical, logical nature when analyzing specific situations for programming, suggest ways to solve them and evaluate the expected results; – systematize and summarize information, prepare references and reviews on professional activities, edit, abstract, review texts; <p>Master the skills:</p> <ul style="list-style-type: none"> – special technical, economic terminology and specialty vocabulary, – independent mastery of new knowledge, using modern educational technologies; – work with technical documentation and literature for solving problems of computer technology and telecommunications; methods of mathematical, simulation and computer modeling of processes and devices of computer technology.
	Basics of working on a personal computer	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – the volume and level of requirements for bachelors in the specialty "Computer Engineering and Software"; – general characteristics of the specialty, area, objects, types of professional activity, tasks of design, research, organizational, managerial and operational activities; – features of various operating systems, architecture. <p>Be able to:</p> <ul style="list-style-type: none"> – identify problems of a technical, logical nature when analyzing specific situations for programming, suggest ways to solve them and evaluate the expected results; systematize and summarize information, prepare references and reviews on professional activities, edit, abstract, review texts; – use basic and special methods of information analysis in the field of professional activity. <p>Master the skills:</p> <ul style="list-style-type: none"> – special technical, economic terminology and vocabulary

			<ul style="list-style-type: none"> – methodology for working with software tools of the appropriate purpose for creating and editing test documents; – carrying out calculations, constructing tables and diagrams; creating databases and working with them; – work with graphic information; – preparing and demonstrating presentations
2	Application packages	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – the concept of an application package; – stages of development of a package of applied programs; – history and stages of development of book printing in Kazakhstan; – the basics of working with the publishing system AdobePageMaker. <p>Be able to:</p> <ul style="list-style-type: none"> – classify software products depending on their purpose; – work with objects in Adobe PageMaker; – format texts in Adobe PageMaker. <p>Master the skills:</p> <ul style="list-style-type: none"> – creation of publications by means of the Microsoft Word program with layout and layout capabilities; – creating documents in Microsoft Office Publisher; – techniques and work with text, objects in Adobe PageMaker; – techniques and creating multi-page publications in Adobe PageMaker
	Introduction to Computational Informatics	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – classification of system and application software; – theoretical foundations of computer software; – purpose and capabilities of basic and applied computer software. – the role and importance of informatics in modern society; – current trends in the development of informatics and computer technology, computer technology <p>Be able to:</p> <ul style="list-style-type: none"> – form approximate (numerical) methods of applied problems; – evaluate the accuracy of the results, apply numerical methods in various areas of practical activity; – apply mathematical methods, physical laws and computer technology to solve practical problems; <p>Master the skills:</p> <ul style="list-style-type: none"> – work with a computer as a means of information management; – basic foundations of algorithmization;

			– personal computer skills.
3	Information theory	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – about the concept of information, methods of transferring digital information, about information processing, security and their technical characteristics and functionality, the foundations of the theory of data compression. <p>Be able to:</p> <ul style="list-style-type: none"> – apply the main models and means of information transfer to optimize modern computer systems. <p>Master the skills:</p> <ul style="list-style-type: none"> – presentation of information; – methods and means of determining the amount of information; – encoding and decoding information.
	Information Technology	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – basic concepts: information and information technologies; – technologies for collecting, storing, transmitting, processing and providing information; – identification and authorization of users and network resources; – information security: main types of threats, ways to counter threats <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – presentation of information; – searching for files, computers and network resources; – methods and means of determining the amount of information.
4	Theory of Probability and Mathematical Statistics	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – patterns in random and information processes (type of distribution, numerical characteristics, accumulation, processing, distribution, etc.) <p>Be able to:</p> <ul style="list-style-type: none"> – create mathematical and computer models of random phenomena in various areas of human activity; <p>Master the skills:</p> <ul style="list-style-type: none"> – information about the main scientific achievements in the theory of probability and mathematical statistics;

	Discrete Math	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – patterns in random and information processes (type of distribution, numerical characteristics, accumulation, processing, distribution, etc.) <p>Be able to:</p> <ul style="list-style-type: none"> – create mathematical and computer models of random phenomena in various areas of human activity; <p>Master the skills:</p> <ul style="list-style-type: none"> – information about the main scientific achievements in the theory of probability and mathematical statistics;
5	Programming languages and technologies	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – programming methods and technologies; – basic data processing algorithms; – about modern programming languages; – on the structure of computing systems; <p>Be able to:</p> <ul style="list-style-type: none"> – develop algorithms; – implement algorithms in a high-level programming language; – implement methods of data analysis and processing; – work in programming environments. <p>Master the skills:</p> <ul style="list-style-type: none"> – methods and technologies for developing algorithms; – programming in a high-level language; – work in various programming environments
	Programming languages	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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.

			<p>Master the skills:</p> <ul style="list-style-type: none"> – 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 CompInt			
2	System Programming	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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 components 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. <p>Be able to:</p> <ul style="list-style-type: none"> – develop programs covering system software issues. <p>Master the skills:</p> <ul style="list-style-type: none"> – 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	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – 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

			<p>efficiency assessments;</p> <ul style="list-style-type: none"> – implement a software tool; – implement a structural and object-oriented approach in working with the toolkit. <p>Master the skills:</p> <ul style="list-style-type: none"> – work on modern technologies for designing software systems (CASE-technologies).
Major disciplines			
University comp1nt			
2	Basics of comp1nt technologies	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – basic concepts of comp1nt programming technologies; – mechanisms for implementing comp1nt programming technologies in the VCL visual comp1nt library; – principles of event-oriented programming; <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – development of application user interfaces based on universal and specialized comp1nts of the VCL library.
	Comp1nt technology and development	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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). <p>Be able to:</p> <ul style="list-style-type: none"> – develop distributed applications using socket technologies, remote procedure calls, comp1nt models, CORBA, web services;

			<ul style="list-style-type: none"> – choose a development technology based on the specifics of the application. <p>Master the skills:</p> <ul style="list-style-type: none"> – development of distributed applications of various types; application of object-oriented programming in distributed systems.
3	Information protection and information security	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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. <p>Be able to:</p> <ul style="list-style-type: none"> – in practice, use the means of protecting information from unauthorized access and destructive software effects. <p>Master the skills:</p> <ul style="list-style-type: none"> – access to electronic information resources, databases, as well as libraries, archives; – adaptation of information resources and information technologies; work with documents containing information
	Data protection	Professional competencies	<p>Know:</p> <ul style="list-style-type: none"> – 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). <p>Be able to:</p> <ul style="list-style-type: none"> – 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. <p>Master the skills:</p> <ul style="list-style-type: none"> – 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 »

No.	Module name	Name of disciplines	Block	Semester	Volume of credits by discipline	form of control	Total credits modulo	
M.1	Module of socio-political knowledge and economics and ecology	Sociology	OOD/OK	2	8	Exam	18	
		Political science				Exam		
		Culturology		1		Exam		
		Psychology	Exam					
		Philosophy	OOD/OK	4		5		Exam
		Fundamentals of market economy and entrepreneurship	OOD/KV	2		3		Exam
		Fundamentals of safety and life and ecology				2		Exam
M.2	Functional literacy	Information and Communication Technologies (in English)	OOD/OK	1	5	Exam	9	
		Application Packages/ Introduction to Computational Informatics	DB /KV	3	4	Exam		
M.3	Introduction to the specialty and algorithmization	Introduction to the specialty / Basics of working on a personal computer	DB /KV	3	6	Exam	16	
		Algorithmization and programming	DB /VK	1	5	Exam		
		Programming languages and technology/Programming languages	BD/CV	5	5	Exam		
M.4	Physics and mathematical statistics	Physics	BD/VK	3	5	Exam	9	
		Educational	VK DB	2	1	Diff credit		
		Probability Theory and Mathematical Statistics / Discrete Mathematics	DB /KV	2	3	Exam		
M.5	Fundamentals of bilingual training	Foreign language	OOD/OK	1,2	10	Exam	20	
		Kazakh (Russian) language	OOD/OK	1,2	10	Exam		
M.6	History of Kazakhstan	History of Kazakhstan	OOD/OK	2	5	GE	5	
M.7	Information theory and information	Information Theory / Information Technology	BD/CV	3	5	Exam	10	

	security	Information security and information security / Information security	PD/ HF	6	5	Exam	
M. 8	Networks and telecommunications	Computer networks and telecommunications/Technology of computer and communication systems	PD/ HF	7	5	Exam	5
M.9	Programming languages	PHP programming/Web programming	PD/ HF	4	3	Exam	5
M.10	Professional languages	Professional Kazakh (Russian) language/	DB/OK	3	3	Exam	6
		Professionally oriented foreign language	DB/OK	6	5	Exam	
M.11	Computer systems	Setup, repair, optimization and maintenance of computer systems / Computer and communication systems engineering	BD/CV	5	5	Exam	10
		Architecture and organization of computer systems	DB/OK	7	5	Exam	
M.12	Graphic modeling	Computer modeling/Mathematical and computer modeling	BD/CV	7	4	Exam	9
		3D graphics and animation/Interactive graphics systems	BD/CV	7	5	Exam	
M 13	Database design	1C programming/Database design	BD/CV	4	5	Exam	5
M.14	System programming and artificial intelligence	System programming	PD / VC	5	5	Exam	27
		Operating Systems/ Operating Systems and Shells	DB /KV	4	3	Exam	
		Fundamentals of comp1nt technology / Comp1nt technology and distributed software development	PD/CV	6	5	Exam	
		AI System/Smart Animation	PD/CV	7	5	Exam	
		Technologies of distributed systems / Technologies of development of distributed information systems	PD/CV	8	4	Exam	
		Fundamentals of Robotics and Artificial Intelligence/Robotic Systems and Complexes	PD/CV	5	5	Exam	
M.15	Circuitry Fundamentals	Electronics	BD/VK	4	5	Exam	15
		Digital circuitry	BD/VK	5	5	Exam	
		Microcontrollers and microprocessor systems/Fundamentals of microprocessor technology	PD/CV	5	5	Exam	
M.16	Software development tools	Software development tools	PD / VC	7	3	Exam	8
		Using Data in Machine Learning /Introduction to machine learning and data analysis	BD/CV	6	5	Exam	

M.17	Object Oriented programming	Object Oriented Programming Delphi / Object Oriented Programming	BD/CV	4	5	Exam	10
		Object-Oriented Programming in C++ \ Functional Programming	BD/CV	6	5	Exam	
M.18	Internet programming	Internet of Things / Design of distributed control systems	PD/ HF	6	3	Exam	8
		Software in Business/Fundamentals of Internet Entrepreneurship	PD / KV	6	5	Exam	
M.19	Programming technologies	Software Development Technology / Software Development Process	PD / KV	8	6	Exam	9
		Modern Methods and Tools for Java Programming / Modern Methods and Tools for NET Programming	PD/ HF	7	3	Exam	
M.20	Physical Culture and sport	Physical Culture	OK OOD	1-4	8	Diff credit	8
M.21	Practice	Production	VK PD	4,6,8	9	Diff credit	16
		Undergraduate	VK PD	8	3	Diff credit	
		Maths	VK/DB	1	4	Exam	
M.22	Final examination	Writing and defending a thesis, graduation project or preparing and passing a comprehensive exam	DVO	8	12	DR/ CE	12