MODULAR EDUCATIONAL PROGRAM
SPECIALTY 6B06124-" COMPUTATIONAL TECHNOLOGY AND SOFTWARE "

Semey, 2021

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Discussed and approved at a meeting of the Department of Information Technology Sciences.
Protocol No. 9 «06» May 2021.
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Reviewed and submitted for approval at a meeting of the Academic Quality Council of the Faculty of Information Technology and Economics.
Protocol No. 1 of «18» February, 2021.

Approved at the meeting of the educational and methodological Council of the University.
Protocol No. 5 «28» May 2021.

CONTENT

Summary of the sections of the MOS
1. Explanatory note

The modular educational program (MOE) was developed on the basis of the state mandatory standard of the Republic of Kazakhstan No. 604 dated 31.10.2018 "Rules for the organization of the educational process on credit technology of education", approved by the Order of the Minister of Educationand Science of the Republic of Kazakhstan dated April 20, 2011 No. 152 (with amendments and additions dated 28.01.2018). Form No. 26 "Structure MOP" dated 01.04.2012 "regulations on the formation of the trajectory of students' education in accordance with the documents within the university. (Appendix No. 33 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken"dated December 18, 2019 No. 255.); and recommendations and wishes of external stakeholders - potential employers were also taken into account (presentation webinar "Employer-UNIVERSITY-Future specialist" dated February 4, 2021 - U-FUTURE LLP, Semey, iMAS GROUP LLP,Semey, JSC "United Energy Service Company" branch in Semey).

The MOS is designed as a set of sequential training modules for the entire period of study and is aimed at mastering the competencies necessary for awarding the Bachelor of Social Knowledge degree in the educational program 6B06124 "Computer Engineering and Software".

The DB block includes disciplines of the university component (VC) – 35 credits and elective components (CV) - 77 credits. Modules of these disciplines form a set of competencies: economic, organizational and managerial, communicative and professional.

The PD block includes disciplines of the university component (VC) -24 credits and elective components (CV) - 36 credits. Modules of these disciplines allow you to form a complex of special competencies acquired by a graduate. The criterion for the completion of the educational process is the student's mastering of 228 credits of theoretical training and IA - 12 credits. The MOS consists of 22 modules that ensure the achievement of the set goals.

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 comp1nt programming technologies in a visual comp1nt 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 sci-

entific 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 legalknowledge, 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 quantitativeand 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 lan-guage 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, cod-ing theory;
- use the conceptual apparatus and methods of discrete mathematics to analyze mathematical models used in computer calculations in solving engi-neering 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 de-termine their characteristics;
- determine the parameters of semiconductor devices and circuitry elements, use methods for constructing various models of data types, informationprocessing 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, installarchitectures 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 structuraland object-oriented approach in working with tools;
- perform typicaldesign tasks,deployment and technicalmaintenance of local and global networks; administer networks in modern operating sys-tems
- 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:s the means and methods of building and organizing dis-tributed 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

№	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	Operating systems/ Operating systems, environments and shells	5	**Know:** concept, principles of construction, types and functions of operating systems;operational environment; machine-independent properties of operating systems.**Be 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 of organizing device support, hardware drivers, network operating systems.
				To know: the current state of the level and directions of development of computer technology and software; the main stages, methods, tools and standards of software development; the 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. **Be 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; create 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.
2		Programming languages and technologies/ Programming languages	5	**Know:** programming methods and technologies; basic data processing algorithms; about modern programming languages; about 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. **Possess skills:** methods and technologies of algorithm development; programming in a high-level language; work in various programming environments
				To know: terminology of the discipline; basic structures and tools that are used in programming languages, for example C++: basic structures and data types of C++; basic methods in the development of algorithms (recursion, backtracking, method of branches and boundaries, analysis of arithmetic expressions); basic algorithms; dialects of C++, including those used when 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; split the solution of a complex problem into a sequence of simpler tasks. **Possess skills:** using a library of standard programs that are included in the C++ programming language; self-mastering a programming language that needs to be used when solving problems**.**
3		Computer networks and telecommunications/ Technics of computer and	6	**To know:** The 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 **to be able to:** Create personal computer schemes; Clean PC from viruses; Apply EDS; Apply encryption principles; Create PHP applications; Create websites with databases; Create a database using phpmyadmin and SQL; Process form data**;**

		communication systems		**Possess skills::** Create a personal data schema; Configure and administer the network; Create applications in PHP; Create and maintain websites; Publish websites on the Internet
				To know: features of control 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 instrumentation for localization of SVT fault locations; application of service tools and built–in test programs; hardware and software configuration of computer systems and installation, configuration and configuration of the operating system, drivers, resident programs; techniques for ensuring the stable operation of computer systems and complexes; rules and regulations of occupational safety , safety, industrial sanitation and fire protection **Be able to:** monitor, diagnose and restore the operability of computer and communication systems; carry out system maintenance of computer and communication systems; take part in debugging and technical tests of computer and communication systems; installation, configuration and configuration of the operating system, drivers, resident programs; comply with safety regulations. **Possess skills:** control, diagnose and restore the operability of computer and communication systems; system maintenance of computer and communication systems; debugging of hardware and software systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs.
4		Object-Oriented Programming in C++\Functional programming	6	**To know:** 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 constructions; methods of composing object-oriented programs in the C++ programming language; capabilities integrated programming environment in C++. **Be able to:** debug and test programs written in C++; formulate a statement of tasks; perform a formalized description of the task, its algorithmization; build a computer program based on the existing algorithm in algorithmic languages and C++. **Possess the skills of:** object-oriented design; development of object-oriented program code in modern operating systems.
				To know: features of artificial intelligence tasks 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. **Be able to:** develop software applications for solving tasks in a functional programming language; develop algorithms for solving problems for functional programming **Possess the skills of:** working with software applications for solving tasks in a functional programming language; developing algorithms for solving problems for functional programming

5		Setting up, repair, optimization and maintenance of computer systems/ Maintenance and repair of computer systems and complexes	6	**To know:** features of control 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 instrumentation for localization of SVT fault locations; application of service tools and built–in test programs; hardware and software configuration of computer systems and installation, configuration and configuration of the operating system, drivers, resident programs; techniques for ensuring the stable operation of computer systems and complexes. **Be able to:** monitor, diagnose and restore the operability of computer systems and complexes; carry out system maintenance of computer systems and complexes; take part in debugging and technical tests of computer systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs. **Possess the skills of:** 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
				Be able to: to monitor, diagnose and restore the operability of computer systems of complexes; to carry out system maintenance of computer systems and complexes; to take part in debugging and technical tests of computer systems and complexes, installation, configuration and configuration of the operating system, drivers, resident programs; to comply with safety regulations; **To know:** features of control 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, methods of providingВладеть навыками: **Possess the skills of:** monitoring, diagnostics and restoration of the operability of computer systems and complexes;
6		Modern methods and means of Java programing / Modern methods and means of NET programing	7	**To know:** types, characteristics of data, operations, language operators; principles of object-oriented programming; fundamentals of computer networks and network associations, Internet services, concepts, Java programming environment. **Be able to:** use classes to process applications; work with files; use the principles of building a graphical interface, graphical primitives; convert applets. **Possess the skills of:** working with operators, with arrays of application processing; creating classes, class methods, publishing objects; creating client components and applications; working with Java network technologies.
				To know: types, characteristics of data, operations, language operators; principles of object-oriented programming; fundamentals of computer networks and network associations, Internet services, concepts, NET programming environment. **Be able to:** use classes to process applications; work with files; use the principles of building a graphical interface, graphical primitives; convert applets. **Possess the skills of:** working with operators, with arrays of application processing; creating classes, class methods, publishing objects; creating client components and applications; works with NET network technologies.
Profile disciplines				
Component of choice				

1	Special competencies	Microcontrollers and microprocessor systems /Fundamentals of microprocessor technics	5	**To know:** the software and logic model of the microprocessor 1810VM86; operating modes of the microprocessor 1810 VM86; principles of construction of microprocessor systems; software and logic model of microcontrollers 1816 series; operating modes of the microcomputer 1816 VE48; features of the organization of the interrupt system of the microprocessor 1810VM86 and microcontroller 1816VE48; memory organization of microcontrollers 1816 series. **Be able to:** build microprocessor systems based on kits 1816 and 1810; test microprocessors as part of computers; **Possess the skills of:** drawing up electronic circuits for the operation of microprocessors and switching methods
				To know: the principles of building electronic devices based on modern element base and MPS; the principles of functioning of electronic devices based on modern element base and MPS; the 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. **Be able to:** carry out the design and calculation of standard nodes of the MPS; carry out the selection of MPS for the required task. **Possess the skills of:** performing analysis and synthesis of electronic circuits with MPS; designing and calculating electronic devices using a computer.
2		Software in business/Fundamentals of Internet Business	6	**To know**: the basic concepts of automated information processing in business processes; the general composition and structure of personal computers and computing systems; the composition, functions and possibilities of using information and telecommunication technologies in business; methods and means of collecting, processing, storing, transmitting and accumulating information; basic system software products and application software packages in the field of professional activity; the practice of organizing the work of an enterprise in the Internet sphere; the specifics of consumer behavior and marketing aspects of Internet entrepreneurship; tools for market research and analysis; the main business models of companies operating in the Internet sphere. **Be able to:** use technologies for collecting, placing, storing, accumulating, converting and transmitting data i professionally oriented information systems; use various types of software, including special ones, i professional activities; use computer and telecommunications tools; conduct entrepreneurial activities i companies of high-tech sectors; develop and implement business models. **Possess the skills of:** technologies for collecting, placing, storing, accumulating, converting and transmittin data in professionally oriented information systems; using methods, techniques, tools for creating an Interne company; planning and evaluating the results of entrepreneurial activity in the Internet sphere
				To know: the practice of organizing the work of an enterprise in the Internet sphere; the specifics of consumer behavior and marketing aspects of Internet entrepreneurship; tools for market research and analysis; the main business models of companies operating in the Internet sphere**.** **Be able to:** conduct business activities in companies of high-tech sectors; develop and implement business models. **Possess the skills of:** using methods, techniques, tools for creating an Internet company; planning and evaluatin the results of entrepreneurial activity in the Internet sphere.
3		Internet of things/ Design of Distributed Control Systems	6	**To know:** the principles of the 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 directions in the field of the Internet of Things.

				Be able to: work with microcontrollers and basic repair plates (Arduino and Raspberry Pi)); understand existing IoT technologies and their application to specific scenarios; design integrated IoT systems (including end devices, network connections, data exchange, cloud platforms, data analysis). **Possess the following skills:** terminology apparatus; basic programming skills of end devices; basic skills for connecting end devices to the network; basic cloud technologies for developing software solutions for data processing and storage.
				To 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 criteria for the effectiveness of DCS; **Be 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.), build modern control algorithms (modal, neuro-fuzzy, network-centric, etc.). determine the network section with the maximum delay in transmitting IP packets; generate HTTP requests and analyze fields HTTP responses; develop hypertext documents. **Possess the skills of:** performing formal construction and transformations of analytical and simulation models of DCS; applying methods and techniques for analyzing and synthesizing DCS architectures; developing and using analytical and simulation models of DCS to evaluate design solutions; -implementing a sequence of stages of designing control and automation systems
4		Programming on PHP/Web programming	7	**Know:** the principles of Internet services; **Be able to:**create static and dynamic pages. **Possess the skills of:** programming and client-server technologies.
				Know: technologies for developing static web sites; techniques for using multimedia (graphics, video, animation) on web pages; client-side software tools used to create web pages; **Be able to:** design and develop the structure of the site; use the HTML hypertext markup language and cascading style sheets (CSS) to create web pages; develop scripts in the JavaScript programming language; **Possess the skills of:** creating web sites; hosting a web site on a server and its maintenance; registering a site in search engines
5		Technologies of distributed systems/Technologies of development of distributed information systems	7	**To know:** principles of construction of distributed information processing systems; database distribution; technology and models of the Client-server network; technologies of object data binding. communication in distributed systems; types of connections; the concept of transaction **Be able to:** use technologies for building and operating distributed information systems. **Possess skills:** works with modern systems of design and development of distributed systems.
				To know: the principles of building distributed information processing systems; communication in distributed systems; types of connections; the concept of transaction **Be able to:** use technologies for building and operating distributed information systems. **Possess the skills of:** working with modern systems of design and development of distributed systems
6		Software development technology/Software development process	8	**To know:** modern trends in the development of computer science and computer technology, computer technology; the basics of creating information systems and the use of new information technologies for information processing; software life cycle; object-oriented programming; theories and methods of classification; elements of complexity theory: theoretical foundations of instrumental software; classical and modern methods of constructing the information structure and interface of the tool**.** **Be 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: choose tools when creating software; apply software construction standards; evaluate the effectiveness of tools

				and analyze qualitative characteristics; implement the cost-effectiveness of software; apply object-oriented and structured distribution methods in control and measuring devices. **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.
				To know: theoretical foundations of tool software; classical and modern methods of building the information structure and interface of the tool. **Be able to**: choose tools when creating software; apply software construction standards; evaluate the effectiveness of tools and analyze quality characteristics; implement the cost-effectiveness of software; apply object-oriented and structured distribution methods in control and measuring devices. **Possess skills:** software development; comparative analysis of the choice of tools.

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

Course	Providing disciplines	Competencies	Expected result
General education disciplines			
Required component			
1	Modern history of Kazakhstan Social and ethical competencies	Modern history of Kazakhstan Social and ethical competencies	**To know:** social and ethical values based on public opinion, traditions, customs, social norms and to focus on them in their professional activities; know the traditions and culture of the peoples of modern Kazakhstan., **Be able to:** make independent conclusions and conclusions; combine theoretical, concrete-historical, source studies and historiographical aspects of the study of the history of Kazakhstan. **Possess skills:** analytical and axiological analysis in the study of complex historical processes, phenomena and historical figures of modern Kazakhstan.
1	Information and communication technologies (in English) Information and communication competencies	Information and communication technologies (in English) Information and communication competencies	**To know**: What economic and political factors contributed to the development of information and communication technologies; features of various operating systems, architecture; **Be able to:** identify the main trends in the field of information and communication technologies; se information resources to search and store information; work with spreadsheets, perform data consolidation, build graphs;apply methods and means of information protection; design and create simple websites; to process vector and bitmap images; to create multimedia presentations; to use various platforms for communication;calculate and evaluate performance indicators of supercomputers; use various forms of e-learning to expand professional knowledge; use various cloud services. **Possess skills:** database structure development; designing and creating presentations; receiving data from the server; creating video files; working with Smart applications; working with services on the e-government website.
1,2	Foreign language Competence in the field of languages	Foreign language Competence in the field of languages	**To know:** basic definitions in the field of English that contribute to the formation of a highly educated person with a broad outlook and a culture of speech; scientific vocabulary and scientific constructions of technical profile in English; rules for producing texts of different genres; pe speech norms of the technical sphere of activity; fundamentals of business communication. **Be able to:** freely conduct a conversation on various topics; use reference literature in English; express your opinion from the point of view of a future specialist in the field of professional activity. use reference literature in English (explanatory dictionaries, reference books, encyclopedias); **Possess the skills of:**competent explanation in English; competent compilation of current documentation in Kazakh-English; building a constructive dialogue;expressing your opinion in English from the point of view of a future specialist in the field of professional activity
1	Kazakh (Russian) language Competence in the field of languages	Kazakh (Russian) language Competence in the field of languages	**To know:** basic definitions in the field of the Kazakh (Russian) language, contributing to the formation of a highly educated person with a broad outlook and culture of speech; scientific vocabulary and scientific constructions of technical profile in the Kazakh (Russian) language; rules for producing texts of different genres; pe speech norms of the technical sphere of activity; fundamentals of business communication. **Be able to:** freely conduct a conversation on various topics; use reference literature in Kazakh (Russian); express your opinion from the point of view of a future specialist in the field of professional activity. **Possess the skills of:**competent explanation in Kazakh (Russian); competent preparation of current documentation in Kazakh (Russian) language; building a constructive dialogue;expressing your opinion in the Kazakh (Russian) language from the point of view of a future specialist in the field of professional activity.
2	Philosophy	Social and ethical competencies	**To know:** the main directions, problems, theories and methods of philosophy, the content of modern philosophical discussions on the problems of socio-philological development. **Be able to:** to form and argumentatively defend one's own position on various problems of philosophy; to use the provisions and categories of philosophy to evaluate and analyze various social trends, facts and phenomena. **Possess the skills of:** public speech, argumentation, discussion and polemics, practical analysis of logic of various kinds of reasoning; written reasoned presentation of one's own point of view, critical perception of information.

1	Sociology	Social and ethical competencies	**To know:** laws of development and functioning of society; features of the analysis of the modern system of social inequality, social mobility and stratification; possess: practical skills of independent analysis of the current state of society. to use basic knowledge in the field of humanities and economic sciences in cognitive and professional activities **Be able to:** correlate the knowledge of the basics of sociology with professional activity; **Possess skills:**general education skills of applying the acquired knowledge in the analysis of real social situations.
1	Political	Science Social and ethical competencies	**To know**: the subject and objectives of the course; the main content of the course "political science"; to master the fundamental knowledge of political theory; the range of achievements of historical thought in the field of the study of ancient culture. **Be able to:** independently work with literature of a general humanitarian nature, be able to find nodal ideological problems and their solutions; to think logically, systematically and critically; use the acquired baggage of philosophical erudition to formulate and prove their own judgments on various issues of everyday life. **Possess skills:** general education.
1	Cultural studies	Science Social and ethical competencies	**To know:** structure and composition of modern cultural knowledge; cultural studies and philosophy of culture; sociology of culture, cultural anthropology; cultural studies and cultural history; **Be able to:** distinguish between the basic concepts of cultural studies: the dynamics of culture, language and symbols of culture, cultural codes, intercultural communication, cultural values and norms, cultural traditions, cultural worldview, social institutions of culture
1	Psychology	Social and ethical competencies	**To know:** The essence of the main psychological processes and properties, mental states that provide a person with his vital activity; basic methods of psychology and be able to use them in the practice of activity, taking into account its economic specifics; psychological theories of personality, group and collective. **Be able to:** to use the acquired knowledge of psychology in their practical activities; organize individual and group activities of people taking into account their psychological characteristics and compatibility; competently use communicative competence in the process of group joint activity. **Possess skills:** methods of developing memory, thinking, analysis and generalization
General education disciplines			
Component of choice			
1	Fundamentals of market economy and entrepreneurship/ Fundamentals of law and anti-corruption culture	OBZH and the fundamentals of the market economy and anti-corruption culture	**To know:** the functions of money, the reasons for differences in the level of wages; the main types of taxes; organizational and legal forms of entrepreneurship; types of securities; factors of economic growth; the current state of the theory and practice of entrepreneurial activity; the specifics of entrepreneurial activity; **Be able to:** give examples of factors of production and factor incomes, public goods, Kazakhstani enterprises of various organizational forms, global economic problems; describe the operation of the market mechanism, the main forms of wages and labor incentives, inflation, the main articles of the state budget of Kazakhstan, economic growth, use the basic terminology of modern entrepreneurship; use methods of doing business; **Skills:** obtaining and evaluating economic information; drawing up a family budget; evaluating one's own economic actions as a consumer, family member and citizen.
			To know: the essence of corruption and the causes of its origin, the measure of moral and legal responsibility for corruption offenses. **Be able to:** possess the skills to acquire new knowledge about the anti-corruption culture is an integral interdisciplinary knowledge system.
1	Fundamentals of market economy and entrepreneurship/ Fundamentals of safety and vital activity	OBZH and the fundamentals of the market economy and anti-corruption culture	**To know:** the functions of money, the reasons for differences in the level of wages; the main types of taxes; organizational and legal forms of entrepreneurship; types of securities; factors of economic growth; the current state of the theory and practice of entrepreneurial activity; the specifics of entrepreneurial activity; **Be able to:** give examples of factors of production and factor incomes, public goods, Kazakhstani enterprises of various organizational forms, global economic problems; describe the operation of the market mechanism, the main forms of wages and labor incentives, inflation, the main articles of the state budget of Kazakhstan, economic growth, use the basic terminology of modern entrepreneurship; use methods of doing business;

			Skills: obtaining and evaluating economic information; drawing up a family budget; evaluating one's own economic actions as a consumer, family member and citizen.
			To know: 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 ensuring comfortable conditions for human life and activity; Be able to: systematize safety standards for use in professional activities; choose methods of protection from hazards in relation to the field of their professional activities and choose ways to ensure comfortable living conditions; Have the skills to ensure the safety of life in industrial, domestic conditions and in emergency situations, the skills of first aid.
Basic disciplines			
Required component			
1	Algorithmization and programming	Professional competencies	To know: features, basic algorithms and their implementation in the chosen programming language (the most preferred are Python, C, Java); know the internal data structures Be able to: use the most common data structures to make drawings of various parts and objects in the specialty Possess skills: basic technologies and mechanisms used in information and computer systems in programming; execution and reading of engineering drawings in the specialty, for example, drawings of parts and subassemblies that are part of the equipment of the printing industry studying and acquiring basic information about the state standards of ESKD, ESTD, SNDS in the specialty.
1	Mathematics	Competencies of natural sciences	**To know**: features, basic algorithms and their implementation in the chosen programming language (the most preferred are Python, C, Java); know the internal data structures **Be able to:** use the most common data structures; to make drawings of various parts and objects in the specialty **Possess skills:**basic technologies and mechanisms used in information and computer systems in programming; execution and reading of engineering drawings in the specialty, for example, drawings of parts and subassemblies that are part of the equipment of the printing industry; studying and acquiring basic information about the state standards of ESKD, ESTD, SNDS in the specialty.
2	Professional Kazakh (Russian) language	Competencies in the field of languages	**To know:** scientific vocabulary and scientific constructions of technical profile; rules for producing texts of different genres; pe speech norms of the technical sphere of activity; fundamentals of business communication. **Be able to:** choose language means, build statements taking into account literary norms and communicative situation; to isolate the logical and compositional structure of the scientific test, to master oral public statements (message, report), to analyze listened public speeches;to carry out communication of a professional nature; use dictionaries and correctly interpret the information obtained from them about language units; to reproduce the read or listened text from the educational, professional, socio-cultural spheres, highlighting the necessary information and presenting it in a certain sequence. **Possess skills:** work with scientific and technical literature; independent search for scientific and technical information as the basis of professional activity; listening to and fully understanding the information of an oral message presented at a normal pace, followed by the transmission of its content; conducting dialogues-inquiries and dialogues of conversations.
2	Professionally-oriented foreign language	Competencies in the field of languages	**To know:** functional features of oral and written texts of a scientific and technical nature in the specialty; documentation requirements accepted in professional communication; strategies of communicative behavior in professional communication situations. **Be able to:** understand oral speech within professional topics; participate in the discussion of topics related to the specialty; independently prepare and make oral presentations on professional topics using multimedia technologies; extract the necessary information from foreign language sources created in various sign systems (text, table, graph, diagram, audio-visual series, etc.); annotate, abstract and present in the native language the main content of the literature on the specialty, if necessary using a dictionary; write messages, articles, theses, abstracts on professional topics. **Possess the skills of:** interpersonal communication in everyday, professional activities in a foreign language; extracting the necessary information from the original text of a professional orientation in a foreign language; the main techniques of annotation, abstracting and translation of literature in the specialty; letters required for the preparation of publications, abstracts and correspondence.

2	Physics	Competencies of natural sciences	**To know**: the essence of the basic concepts, laws, theories of classical and modern physics in their internal interrelation and integrity, the concept of physical laws, the limits of their applicability, allowing effective use 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; to assess the degree of reliability of the results of experimental and theoretical research methods; to use the achievements of fundamental science for the successful study of general theoretical and special technical disciplines, the development of mathematical thinking and logic. **Possess skills:** evaluation of the degree of reliability of the results obtained using experimental or theoretical research methods; conducting a physical experiment.
2	Digital circuitry	Профессиональные компетенции	**To know:** general information about the element base of circuitry (resistors, capacitors, diodes, transistors, microchips, ontoelectronics elements), functional nodes (decoders, encoders, multiplexers, demultiplexers, digital comparators, adders, triggers, registers, counters), storage devices for basic BIS/VLSI, logic elements and logic design in the bases of microcircuits, digital-analog and analog-to-digital converters. **Be able to:** determine the parameters of semiconductor devices and system engineering elements. **Possess skills:** selection of types (family) of digital elements according to the specified parameters; design and simulation of basic electrical circuits of digital devices; work with virtual laboratory software packages and real measuring instruments.
3	Electronics	Профессиональные компетенции	**To know:** purpose, applications 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, make a mathematical description of the functioning of devices and determine their characteristics. **Possess skills:** calculation and design of electronic devices, circuits and devices of various functional ; assignments in accordance with the terms of reference and using design automation tools, voltage measurement on electronic circuits (using a digital voltmeter, oscilloscope, etc.); the 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	Профессиональные компетенции	**To know:** about the concept of computer architecture, the principles of organization of multiprocessor and multi-machine computing systems, the directions of development of computers with traditional, parallel and non-traditional architecture, the reasons for building data transmission networks, the protocol and the layered model of description and implementation of protocols. **Be able to:** formulate technical requirements taking into account the functions performed by computing systems, and justify a rational architecture, determine tools for the performance of computing systems, configure a computer to work in a local network and the Internet, create an address computer network. **Possess the skills of:** choosing the architecture and integration of modern computers, systems and networks; system administrator.
Basic disciplines			
Component of choice			
2	Introduction in specialty/ Basics of work on a personal computer	Professional competencies	**Know:** the volume and level of requirements for bachelors in "Computer science and software", the content of the curriculum for the period of study; physical basis of PC operation, its main technical characteristics and functionality; professional problems in the field of computing and telecommunications; general description of specialty, field, objects, types of professional activity, tasks of design, research, organizational, managerial and operational activities; features a variety of operating systems and architecture. **Able to:** to put, formulate problems of technical projects for the implementation of programming tasks and technical solutions in the professional field; identify technical and logical problems in the analysis of specific situations for programming, suggest ways to solve them and evaluate the expected results; to systematize and generalize information, to prepare references and reviews in professional activities, edited, abstracted, reviewed texts; use basic and special methods of information analysis in the field of professional activity; to develop and prove variants of effective decisions; critically evaluate from different sides (production, motivational, institutional, etc.) the development trends of objects in the field of professional activity; knowledge gained in the study of mathematics, physics; plan and conduct research, analyze and interpret the data obtained; analyze, program, design and operate software and hardware systems and security systems; use modern technical means necessary in engineering practice.

			Possess skills: special technical, economic terminology and vocabulary, self-mastery of new knowledge, using modern educational technologies; work with technical documentation and literature to solve problems of computer engineering and telecommunications; - methods of mathematical, simulation and computer simulation of processes and devices of computer technology.
			Know: the volume and level of requirements imposed to bachelors in the specialty "Computer facilities and software»; the general characteristic of specialty, area, objects, types of professional activity, tasks of design, research, organizational and administrative and operational activity; features of different operating systems, architecture. **Able to:** to identify problems of a technical and logical nature in the analysis of specific situations for programming, to suggest ways to solve them and to evaluate the expected results; to systematize and summarize information, to prepare references and reviews on professional activities, to edit, to refer, to review the texts; use basic and special methods of information analysis in the field of professional activity; to develop and prove variants of effective decisions; critically evaluate from different sides (production, motivational, institutional, etc.) trends in the development of objects in the field of professional activity; apply the knowledge gained in the study of mathematics, physics; plan and conduct research, analyze and interpret the data obtained; analyze, program, design and operate software and hardware systems and security systems;to use modern technical tools necessary in engineering practice. **Possess skills:** special technical, economic terminology and vocabulary of the specialty
2	Application Packages/ Introduction to computer science	Professional competencies	**Know:** the concept of an application package; stages of development of the software package; history and stages of book printing development in Kazakhstan; the concept of office application packages; the concept of desktop publishing systems; the concept and purpose of technical means of publishing systems; basics Adobe Page Maker publishing system. **Able to:** classify software products according to their purpose; to classify the software packages in the types of; to create texts which are published in Adobe Page Maker; work with objects in Adobe Page Maker; to format texts in Adobe Page Maker. **Possess skills:** creation of publications by means of the program Microsoft Word with the possibilities of layout and typesetting; create documents in Microsoft Office Publisher; techniques and ways to create booklets and the layout work in Microsoft Office Publisher; work in publishing systems; techniques and skills for working with text and objects in Adobe PageMaker; techniques and create multi-page publications in Adobe Page Maker.
			Know: classification of system and application software; theoretical basis of computer software; purpose and capabilities of basic and applied computer software. **Able to:** to form approximate (numerical) methods of applied problems; to assess the accuracy of the results, to apply numerical methods in various fields of practice. **Possess skills:** work with the computer as a means of information management.
2	Information theory/ Information technologies	Professional competencies	**Know:** basic concepts: information and information technology; technologies for collecting, storing, transmitting, processing and providing information; classification of information technologies by fields of application: processing of text and numerical information, hypertext methods of storage and presentation of information, document markup languages; general information about computers and computer networks: the concept of information system, data, databases, personal computer, server; assign the computer a logical and physical structure of computer, hardware and software; processor, RAM, disk and video subsystems; peripherals: interfaces, cables and connectors; personal computer (PC) operating system, file systems, file formats, file management programs; local networks: protocols and standards of local networks; topology of networks, structured cabling systems, network adapters, hubs, switches, logical network structuring; identification and authorization of users and network resources; General information on global computer networks(Internet), addressing, domain names, data protocols, hypertext presentation, WorldWideWeb network (WWW), e-mail, server and client software; information security: main types of threats, ways to counteract 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; work with file systems, different file formats, file management programs; work in applications: text and table editors, presentation editor, use information from technical documentation and help files. **Possess skills:** presentation of information; search for files, computers, and network resources; methods and means of determining the amount of information.

			Know: basic concepts: information and information technology; technologies for collecting, storing, transmitting, processing and providing information; classification of information technologies by fields of application: processing of text and numerical information, hypertext methods of storage and presentation of information, document markup languages; general information about computers and computer networks: the concept of information system, data, databases, personal computer, server; assign the computer a logical and physical structure of computer, hardware and software; processor, RAM, disk and video subsystems; peripherals: interfaces, cables and connectors; personal computer (PC) operating system, file systems, file formats, file management programs; local networks: protocols and standards of local networks; topology of networks, structured cabling systems, network adapters, hubs, switches, logical network structuring; identification and authorization of users and network resources; General information on global computer networks(Internet), addressing, domain names, data protocols, hypertext presentation, WorldWideWeb network (WWW), e-mail, server and client software; information security: main types of threats, ways to counteract 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; work with file systems, different file formats, file management programs; work in applications: text and table editors, presentation editor, use information from technical documentation and help files. **Possess skills:** presentation of information; search for files, computers, and network resources; methods and means of determining the amount of information.
2	Object-oriented programming Delphi/ Object-oriented programming	Professional competencies	**Know**: fundamentals of algorithmization and principles of algorithm construction.; the concept of programming.; classification of programming languages; the algorithms to solve problems; methods and important ways of constructing algorithms. **Able to**: object-oriented design; develop programs in an object-oriented programming environment.; use object-oriented programming languages to solve problems in the subject area; to create application software packages. **Possess skills**: object-oriented programming languages; algorithmization and work in the programming environment; practical skills of object-oriented programming.; fundamentals of object-oriented design and analysis.
			Know: what is a class and object; the basic principles of object-oriented programming; principles classes; criteria for checking the correctness of the construction of classes; main trends in the development of object-oriented programming technologies. **Able to:** use modern methods of object-oriented programming in coding software systems of different complexity levels; **Possess skills:** work with the environment of visual programming Delphi; basics of algorithmization.
1	Probabilities theory and Math statistics/ Discrete mathematics	Professional competencies	**Know:** - regularities in random and information processes (type of distribution, numerical characteristics, accumulation, processing, distribution, etc.)) **Able to:** - create mathematical and computer models of random phenomena in various fields of human activity; **Own skills:** - information about the main scientific achievements in the theory of probability and mathematical statistics;
			Know: basic concepts of sets; algebraic methods model description; elementary functions of logic algebra, properties and their analytical representation; foundations of the logical calculus of propositional and predicate; methods for solving classical problems formulated in terms of combinatorics**.** **Able to:** to apply combinatorial configuration for solving problems to determine the type of binary relations and its properties, perform operations on sets to represent graphs in different ways, to perform operations on graphs, finding shortest path graph, construct the truth table Boolean function, perform the identity transformation, find SDNF, SCNF to determine the minimum DNF. **Possess skills:** use of basic tools of discrete mathematics for solving applied problems; method of construction, analysis and application of discrete models in professional activity.
3	Operating systems / Operating systems, environments and shells	Special competencies	**Know:** the concept, principles, types and functions of operating systems; operating environment; machine-independent properties of operating systems. **Able to:** install and maintain operating systems; take into account the peculiarities of work 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 construction of operating systems; ways of organizing device support, hardware drivers, network operating systems.

			Know: 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, operating system resource management principles; features of operation in specific operating environments and shells; service software tools; methods of organizing, storing and processing information on the computer (technology of processing information on the computer). **Able to:** to work in a chosen environment;to learn a new operating system or shell program; to obtain information about users, processes, directories, reference on system commands; to perform a message exchange with other users; create and view directories, copy, move and delete files, manage file access mode; to create, view and merge text files, search pattern, search file according to the specified parameters, to use pipelines and redirection input / output. **Possess skills:** security and fault tolerance of operating systems; principles of construction of operating systems and shells; ways of organizing device support, hardware drivers, network operating systems.
3	Programming languages and technologies / Programming languages	Special competencies	**Know:** programming methods and technologies; asic data processing algorithms; about modern programming languages; about the structure of computing systems; **Able to:** develop algorithms; to implement algorithms in the programming language high-level; implement the methods of analyzing and processing data; work in programming environments. **Possess skills:** methods and technology development of algorithms; high-level programming language; work in various programming environments.
			Know: terminology of discipline; basic structures and tools that are used in programming languages such as C++: main structures and types of C++ data; main methods in the development of algorithms (recursion, backward, branch and boundary methods, analysis of arithmetic expressions); basic algorithms; dialects C++, including used in programming microcontrollers; library of standard programs. **Able to:**to apply programming techniques in the development of information systems; determine data structures in the design of algorithms in the process of solving problems; break down the solution of a complex problem into a sequence of more simple tasks. **Possess skills:** use the library of standard programs that are included in the programming language C++; self-settling in the programming language that you must use when solving problems.
3	Computer networks and telecommunications / Technics of computer and communication systems	Special competencies	**know**: The main components of the network, types of communication lines; IP address types; Methods and means of network protection; PHP syntax; SQL syntax; Types of domain and types of hosting **Able to:** Create schemes HP; Clean your PC from viruses; Apply a digital signature; To apply the principles of encryption; Create PHP applications; Create websites with DB; Create a database using phpmyadmin and SQL; To process form data **Own skills :** Create a LAN scheme; Perform network configuration and administration; - Create applications in PHP - Creation and maintenance of websites - Publication of web-sites on the Internet
			Know: features monitoring and diagnostic devices hardware and software systems; main diagnostic methods; hardware and software functional control and diagnosis of computer systems capabilities and applications of standard and special test equipment to locate the ground fault SWT; 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 to ensure the stable operation of computer systems and complexes; rules and norms of labor protection, commercial ; safety, industrial sanitation and fire protection **Able to:** monitor, diagnose and restore the performance of computer and communication systems; carry out system maintenance of computer and communication systems; take part in debugging and technical testing of computer and communication systems; installation, configuration and configuration of the operating system, drivers, resident programs; to perform the safety procedures. **Possess skills:** carrying out of control, diagnostics and restoration of working capacity of computer and communication systems; system engineering services of computer and communication systems; debugging of hardware-software systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs.отладки аппаратно-программных систем и комплексов; инсталляции, конфигурирования и настройки операционной системы, драйверов, резидентных программ.

3	Object-oriented programming in C++/ Functional programming	Special competencies	**Know:** the concept of object-oriented programming, its basic concepts (class, object), properties (encapsulation, inheritance, polymorphism); method of analysis and design of object-oriented programs; the basic concepts, the syntax and semantics of the constructs of the programming language C++; methods of drawing up object-oriented programs in C++programming language; features of the integrated programming environment in C++. **Able to:** debug and test programs written in C++; formulate the problem statement; 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:** object-oriented design; development of object-oriented software code in modern operating systems.
			Know: features of artificial intelligence problems and the role of functional programming as methodologies for solving these problems; trends and prospects of functional programming tools development; fundamentals of lambda calculus theory and practice. **Able to:** develop software applications for solving the tasks in the functional programming language; develop algorithms for solving problems for functional programming **Possess skills:** work with the software application for solving of the tasks in a functional programming language; development of algorithms for solving problems for functional programming.
3	Setting up, repair, optimization and maintenance of computer systems/ Technics computer and communication systems	Special competencies	**Know:** features monitoring and diagnostic devices hardware and software systems; main diagnostic methods; hardware and software functional control and diagnosis of computer systems capabilities and applications of standard and special test equipment to locate the ground fault SWT; 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 of ensuring stable operation of computer systems and complexes. **Able to:** to control, diagnose and restore the performance of computer systems and systems; to carry out system technical maintenance of computer systems and complexes; take part in debugging and technical testing of computer systems and systems; installation, configuration and configuration of the operating system, drivers, resident programs. **Possess skills:** carrying out of control, diagnostics and restoration of working capacity of computer systems and complexes; systems engineering computer systems and complexes; debugging of hardware-software systems and complexes; installation, configuration and configuration of the operating system, drivers, resident programs.
			Know: to control, diagnose and restore the performance of computer systems complexes; - 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; **Able to:** features of control and diagnostics of devices of hardware and software systems; main diagnostic methods; hardware and software for functional control and diagnostics of computer systems and complexes, possibilities and applications of standard and special control and measuring equipment for localization of fault locations of SVT; 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, methods of ensuring the stable operation of computer systems and complexes; rules and norms of labor protection, safety, industrial sanitation and fire protection. **Own skills:** monitoring, diagnostics and recovery of computer systems and complexes;
4	1C programming/ Database design	Special competencies	**Know**: principles of construction of 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; **Be able to:** design separate target mechanisms of automatic machines and automatic lines; to design an automatic machine tool systems; perform calculations of the performance and reliability of automatic equipment; **Possess skills:** analysis of the performance, reliability and cost-effectiveness of automatic lines; processing and analysis of statistical information on the reliability, performance and efficiency of automatic systems operation
			Know: features of the relational model and their impact on database design, visual AIDS used in ER modeling; basics of relational algebra; principles of database design, ensuring the consistency and integrity of data; design database structures; SQL query language.

			Able to:design a relational database;use SQL to programmatically retrieve information from databases. **Possess skills:**searching and structuring information; modern techniques and technologies for the development and support of technical systems.
4	Computer- modeling/ Mathematical and computer modeling	Professional competencies	**Know:**main concepts of modeling theory, classification of models and their use, modeling problems; main modeling tools used in the process of designing systems at different stages of project detail; methods of modeling and analysis of systems; principles of construction of models. **Able to:**perform an analysis of the system or process under study; reasonably choose a modeling method; to build an adequate model of the system or process using modern computer tools; to interpret and analyze the simulation results. **Possess skills:**the main criterion of evaluation of the obtained simulation results; experience of work and use in simulation of scientific and technical information
			Know: methods for solving basic mathematical problems-integration, - differentiation, solving linear and transcendental equations and systems of equations using computers; basic principles of mathematical models;the main types of mathematical models. **Able to:** use basic numerical methods for solving mathematical problems;to develop algorithms and programs for solving computational problems, taking into account the necessary accuracy of the result;to select analytical methods for studying mathematical models;to use numerical methods for studying mathematical models. **Possess skills:** the solution of computational problems using computer modeling.
4	Modern methods and Java software/ Modern methods and software NET	Professional competencies	**Know:** types, the characteristics of the data operations, and language operators; principles of object-oriented programming; fundamentals of computer networks and associations of networks, the internet, concepts, programming environment Java. **Able to:** use classes to process applications; work with files; use the principles of building a graphical interface, graphical primitive; convert applets. **Possess skills:** work with operators, with arrays of application processing; create classes, methods, publications, objects; creating client components and applications; work with Java network technologies.
			Know: types, the characteristics of the data operations, and language operators; principles of object-oriented programming; basic principles of computer networks and networking, internet services, concepts, programming environment NET. **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; create classes, methods, publications, objects; creating client components and applications; work with NET network technologies.
4	The use of data in machine learning / Introduction to machine learning and data analysis	Professional competencies	**Know**: principles for constructing feature vectors, decision rules, and classification; main types of classifiers; principles of construction of linear classifiers; principles of constructing nonlinear classifiers; selection of classification features and features of pre - processing of data. **Able to:** selecting the appropriate type of classifier depending on the problem being solved; selecting a set of features for classification and pre-processing data; ability to use algorithms for training and compiling a classifier for selection; Performing calculations related to the study and operation of the classifier in the MATLAB environment **Skills**: skills for selecting, creating, training, and using basic classifiers problem solving
			Know: the main methods of data transformation; know the main tasks of machine learning; the main models of machine learning; Main stages of the machine learning project **Able to:** these works massivement; Formalizing a business task as a machine learning task solving machine learning tasks in specific business tasks **Skills**: Loading, converting, clearing, and visualizing data in Python; Applying machine learning models in Python; quality assessment and interpretation of the results obtained

4	3D graphics and animation/ Interactive graphics systems	Professional competencies	**Know:**EN basic concepts of three-dimensional graphics; features of 3D Studio max; principles of creation, modification, texturing and lighting of objects on the subject plane, types of lighting, features of color rendering; the principles and methods of transmitting motion in animation; General principles for the development of the project in 3D Studio max; the steps of creating a project in 3D Studio MAX. **Able to:**create a fixed three-dimensional scene in accordance with the rules of artistic and technical design taking into account color-package solutions; to create a simple animated three-dimensional scene using 3D Studio max;to export and import image files into the 3D Studio MAX; develop and submit to the defense your project created by the program in 3D Studio MAX. **Possess skills:**create 3D graphics in 3D Studio max, Autodesk 3ds Max, and AutodeskMaya 3d.
			Know:on the basics of two-dimensional, three-dimensional graphics, operations with graphic objects. **Able to:** practically to use means of computer graphics at designing of products and means of equipment of technological processes;perform operations on graphical objects. **Possess skills:**basic techniques for the creation, conversion and editing of multimedia data; enterprises multimedia information in a single information field; use of techniques for creating three-dimensional computer graphics to correctly apply them in future professional activities
4	Fundamentals of robotics and artificial intelligence/ Robotic systems and complexes	Professional competencies	**Know**: mathematical models of systems of automation and robotization of production processes using modern software data; analyze and evaluate mathematical models of systems of robotization and automation of production processes using modern software data. **Be able to**: design automation and robotization systems; comparative analysis with the use of modern software products for the robotization of technological complexes and systems for automating production processes in various industries, as well as artificial intelligence methods.; **Possess the skills** to form modern trends in the development of robotic systems and automation of production processes
			Know: industrial robot control systems; about remotely controlled robots; **Be able to**: solve programming problems using robotic systems **Possess the 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
Profile disciplines			
Required component			
2	System programming	Professional competencies	**To know:** basic theoretical and practical skills of system programming at the level of program development, allowing to obtain modern programs of complex logical structure at the lowest cost; about the composition and principles of management of PC systems and networks; about the purpose of the components of the operating system; the principles of functioning of various elements of operating systems.; 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, mutexes, semaphores. **Be able to:** develop programs covering system software issues. **Possess skills:** working with various operating systems and their administration; procedural and object-oriented programming languages;development and debugging of programs in at least one of the high-level algorithmic procedural programming languages.
3	Software development tools	Professional competencies	**To 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 of building instrumental software; international and domestic standards used in the development of software products; classical and modern approaches to the construction of the interface and information structure of the toolkit. **Be able to:** use the unified modeling language UML and apply CASE tools (BPwin, Erwin, ARIS, Modelmart, Rational Rose, Microsoft Office Visio 2007) when designing software systems; selection of a tool that provides the stages of the life cycle of programs; in the practical use of the development and implementation of software products;use of standards for building software tools; analysis of characteristics, quality and evaluation of the effectiveness of the use of tools; evaluation of economic efficiency; implementation of a software tool; implementation of a structural and object-oriented approach to working with tools. **Possess skills:** works on modern software system design technologies (CASE-technologies).

Profile disciplines			
University component			
2	Fundamentals of component technologies / Component technologies and distributed software development	Professional competencies	**Know:**main types of distributed applications; modern development technologies and development of distributed applications; main distributed object technologies and architectures (service-oriented architecture, component architecture, agent architecture, CORBA architecture). **Able to:**develop distributed applications using socket technologies, remote procedure calls, component models, CORBA, web services; select the development technology based on the specifics of the application. **Possess skills:** development of distributed applications of different types; the use of object-oriented programming in distributed systems.
			Know: main types of distributed applications; modern development technologies and development of distributed applications; main distributed object technologies and architectures (service-oriented architecture, component architecture, agent architecture, CORBA architecture). **Able to:** develop distributed applications using socket technologies, remote procedure calls, component models, CORBA, web services;select the development technology based on the specifics of the application. **Possess skills:** development of distributed applications of different types; the use of object-oriented programming in distributed systems.
3	Information security and information safety\ Data protection	Professional competencies	**Know:**about protection of information of computer systems, the main subsystems of the computer, which cover concepts such as system highways, internal and external memory; requirements for information security systems; on the protection of corporate networks, the principles of security of information processing systems; main characteristics of cryptographic methods of information protection. **Able to:** in practice, to use means of information protection against unauthorized access and destructive software actions. **Possess skills:** access to electronic information resources, databases, libraries, archives;ь adaptation information resources and information technology; work with documents containing restricted information.
			Know: about protection of information of computer systems, the main subsystems of the computer, which cover concepts such as system highways, internal and external memory; requirements for information security systems; on the protection of corporate networks, the principles of security of information processing systems; main characteristics of cryptographic methods of information protection. **Able to:** in practice, to use means of information protection against unauthorized access and destructive software actions. **Possess skills:** access to electronic information resources, databases, libraries, archives; adaptation information resources and information technology; work with documents containing restricted information.
3	Microcontrollers and microprocessor systems/ Fundamentals of microprocessor technics	Special competencies	**Know:** program-logic model of microprocessor 1810BM86; odes of operation of the microprocessor 1810 BM86; principles of construction of microprocessor systems; program-logic model MCU series 1816; modes of operation of micro-computer 1816 WE48; features of the organization of system interrupts microprocessor and microcontroller 1810BM86 1816BE48; organization of memory of 1816 series microcontrollers**.** **Able to:** to build microprocessor systems on the basis of sets of 1816 and 1810; to test the microprocessors in computers **Possess skills:**composing electronic circuits for the operation of microprocessors and how to incorporate
			Know:principles of construction of electronic devices on the basis of modern element base and MPs;principles of functioning of electronic devices on the basis of modern element base and MPs;main technical parameters, performance characteristics and application fields of the main devices and functional units of electronics and MPs;the basic principles of designing circuits on the basis of the IPU. **Able to:**to perform the design and calculation of standard units of MEAs;to make a choice of MPs to the required task. **Possess skills:**perform analysis and synthesis of electronic circuits with MPs;of design and analysis of electronic devices with the help of computers.

3	Artificial intelligence systems/ Intelligent animation	Professional competencies	**Know:**main theoretical and practical skills of system programming at the level of program development, allowing to obtain modern programs of complex logical structure at the lowest cost; about the composition and principles of PC management systems and networks; the appointment of components of the operating system; the principles of functioning of the various elements of the operating systems interaction; generation and processing of processes in the system; main methods and principles of programming in modern operating systems; main concepts such as: kernel objects, processes, threads, priorities, security attributes, heaps, mutexes, semaphores. **Able to:** to develop programs: covering issues of system software. **Possess skills:** skills of working with different operating systems and their administration; languages procedural and object-oriented programming, skills development and debugging of programs by no less than one of algorithmic procedural programming languages of high level.
			Know: history of artificial intelligence. about applied systems of artificial intelligence. all kinds of animation. **Able to:** navigate in different types of intelligent systems; to navigate and the various knowledge representation methods, to go from one method to another; formalize the knowledge of experts using different methods of knowledge presentation;create short films. **Possess skills:**the development of production knowledge bases for solving the problem of choice of options in poorly formalized subject area; applications of basic neural network models.
3	Software in business / Fundamentals of Internet Business	Special competencies	**Know:**the basic concepts of automated data 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 gathering, processing, storage, transmission and accumulation of information; underlying system software products and packages of applied programs in the field of professional activities; main methods and techniques of information security. **Able to:**to use technology for the collection, distribution, storage, accumulation, conversion and transmission of data in a professionally oriented information systems; use various types of software, including special software, in professional activities.; to use computer and telecommunication resources. **Possess skills:** technology for the collection, distribution, storage, accumulation, conversion and transmission of data in a professionally oriented information systems.
			Know:practice of organization of work of the enterprise in the online sphere; specific features of consumer behavior and marketing aspects of Internet entrepreneurship; market research and analysis tools; main business models of companies working in the Internet sphere. **Able to:** conduct a business activity in companies of high-tech sectors; to develop and implement the business model. **Possess skills:** the use of methods, techniques, tools to create an Internet company; planning and assessing the business activities in the Internet sphere.
3	Internet of things / Design of Distributed Control Systems	Special competencies	**Know:** principles of organization and functioning of the "Internet of things" History of the origin and development of the "Internet of things" main factors in the development of the " Internet of things" Existing technologies in the Internet of things industry" Main trends and directions in the field of "Internet of things". **Be able to:** work with microcontrollers and main 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:** terminology; basic knowledge of programming end devices; basic skills for connecting end devices to the network; - basic cloud technologies for developing software solutions for data processing and storage.
			Know: properties, characteristics and architecture (structure and topology) of distributed control and automation systems (DCS),types of support {methodical, technical, software, informational, metrological, ergonomic, organizational and legal); functional objectives and performance criteria of DCS. **Able to:** to carry out projects of means of automation, systems of automation of technological processes: perform automation of research and testing: design and implement algorithms for preprocessing information (compression, filtering, improving the accuracy of conversion, etc.).), Build modern control algorithms (modal, neuro-fuzzy, network - centric, etc.). to determine the section of the

			network with the maximum transmission delay of IP packets; to form HTTP requests and parse the fields in the HTTP response; develop hypertext documents. **Possess skills:** implementation of formal construction and transformation of analytical and simulation models of DCS; the application of methods and techniques for the analysis and synthesis of RSU architectures; development and use of analytical and simulation models of DCS for evaluation of design solutions; implementation of the sequence of design stages of control and automation systems.
3	Programming on PHP/ Web programming	Special competencies	**Know:** principles of Internet services; **Able to:** create static and dynamic pages. **Possess skills:** programming and client-server technologies.
			Know: static web-site development technologies; methods of 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; placement of the web-site on the server and its maintenance; registration of the site in search engines.
4	Technologies of distributed systems / Technologies of development of distributed information systems	Special competencies	**Know:** principles of distributed information processing systems construction; distribution database; Client-server network technology and models»; technology object data binding. **Able to:** to use technology in development and maintenance of distributed information systems. **Possess skills:** works with modern systems of design and development of distributed systems.
			Know: principles of distributed information processing systems construction; communication in distributed systems; link type; the notion of a transaction. **Able to:** to use technologies of construction and operation of the distributed information systems. **Possess skills:** works with modern systems of design and development of distributed systems
	Software development technology/ Software development process	Special competencies	**Know:** modern trends in computer science, computer technology; basis of creation of information systems and use of new information technologies of information processing; life cycle of the software; object-oriented programming; theories and methods of classification; elements of complexity theory. **Able to:** use mathematical methods, physical laws and computational techniques to solve practical problems; program in one of algorithmic languages; to apply algorithms of information retrieval IN software development. **Possess skills:** drafting of projects for the development of modern software; technologies of data collection, processing, transmission and storage. **Know:** theoretical basis of software tools; classical and modern methods of building the information structure and interface of the tool. **Able to:** select tools when creating software; to apply the standards of construction of the software; to assess the effectiveness of tools and the analysis of qualitative characteristics; realize the economic efficiency of the software; to apply object-oriented and structured methods of distribution in control and measuring instruments. **Possess skills:** software development hard; comparative analysis of selection tools.

Table 3. List of modules in the specialty 6B06124-"Computer engineering and software"

Module No.	Name of the module	List of disciplines included in the module	Block	Term	Loan volume	Module No.	Name of the module
M.1	OBZH and the fundamentals of the market economy and anti-corruption cultures	Sociology	MC GED	2	8	Exam	18
		Political Science					
		Cultural studies		1			
		Psychology					
		Fundamentals of market economy and entrepreneurship/ Fundamentals of law and anti-corruption culture	GED/OC	2	3		
		Fundamentals of market economy and entrepreneurship/ Fundamentals of safety and vital activity			2		
		Philosophy	MC GED	4	5		
M.2	Functional literacy	Information and Communication Technologies (in English)	MC GED	1	5	Exam	9
		Application software packages/ Introduction to Computational Informatics	BD / SC	3	4		
M.3	Introduction to the specialty and algorithmization	Introduction to the specialty / Basics of working on a personal computer	BD / SC	3	6	Exam	16
		Algorithmization and programming	BD /BK	1	5	Exam	
		Programming languages and technology/Programming languages	BD \SC	5	5	Exam	
M.4	Mathematics and Physics	Mathematics	BD / UC	1	4	Exam	12
		Physics	BD / UC	2	5	Exam	
		Probability Theory and Mathematical Statistics/ Discrete Mathematics	BD / SC	2	3	Exam	
M.5	Basics of bilingual training	Foreign language	MC GED	1,2	10	Exam	20
		Kazakh (Rus) language	MC GED	1,2	10	Exam	
M.6	Modern history of Kazakhstan	Modern history of Kazakhstan	MC GED	2	5	SE	5
M. 7	Information theory and information security	Information Theory / Information Technology	BD / SC	3	5	Exam	10
		Information protection and information security/ Information protection	ПД/ SC	5	5	Exam	
M.8	Networks and telecommunications	Computer networks and telecommunications/Computer and communication systems engineering	ПД/ SC	6	5	Exam	5
M.9	Programming languages	Programming in PHP/Web programming	ПД/ SC	7	5	Exam	5
M 10	Professional languages	Professional Kazakh (Russian) language/	BD /RC	4	3	Exam	6
		Professionally-oriented foreign language	BD / RC	3	3	Exam	
M.11	Computer systems	Setup, repair, optimization and maintenance of computer systems/ Computer and Communication Systems Engineering	BD / SC	6	5	Exam	10
		Architecture and organization of computer systems	BD / RC	5	5	Exam	
M.12	Graphical modeling	Computer simulation/Mathematical and computer modeling	BD / SC	7	3	Exam	7

		3D graphics and animation/Interactive graphics systems	BD / SC	7	4	Exam	
M.13	Database	1C programming/Database design	BD / SC	7	5	Exam	5
M.14	design System programming and artificial intelligence	System programming	MD / UC	4	5	Exam	28
		Operating systems/ Operating systems and shells	BD / SC	5	5	Exam	
		Fundamentals of Component Technologies/ Component technologies and Distributed Software development	MD / SC	4	3	Exam	
		Artificial Intelligence system/Intelligent animation	MD / SC	6	5	Exam	
		Distributed systems technologies/Technologies for the development of distributed information systems	MD / SC	7	5	Exam	
		Fundamentals of robotics and artificial intelligence/Robotic systems and complexes	MD / SC	1	5	Exam	
M 15	Fundamentals of circuit design	Electronics	BD /UC	5	5	Exam	15
		Digital circuitry	BD / UC	4	5	Exam	
		Microcontrollers and microprocessor systems/Fundamentals of microprocessor technology	MD/SC	5	5	Exam	
M 16	Software development tools	Software development tools	MD/ UC	5	5	Exam	9
		Using Data in Machine Learning	BD / SC	7	4		
M 17	Object-oriented programming	Delphi Object-oriented Programming / Object-oriented programming	BD\ SC	4	5	Exam	10
		Object-oriented programming in C++ \ Functional programming	BD / SC	6	5	Exam	
M. 18	Programming on the Internet	Internet of Things/ Design of distributed control systems	MD / SC	6	3	Exam	8
		Software in business/Fundamentals of Internet entrepreneurship	MD / SC	6	5	Exam	
M.19	Programming technologies	Software Development Technology / Software Development Process	MD /SC	8	6	Exam	9
		Modern methods and tools programming in Java / Modern methods and tools of NET programming	MD / SC	7	3	Exam	
M.20	ATT	Physical Culture	ATT	1-4	8	dif offset	8
M. 21	Practice	Educational	ATT	2	1	test	13
		Production	ATT	4,6,8	9	test	
		Pre - graduation	ATT	8	3	test	
M.22	Final certification	State examination in the specialty	FC	8	12	FC	12
		Writing and defending a thesis	FC	8		GW	