6B06123 "IT IN HEALTHCARE"
MODULE EDUCATIONAL PROGRAM

2021

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Summary of the educational program

1. Explanatory note

The modular educational program (MODE) is approved by the Government of the Republic of Kazakhstan dated 21.10.2018 № 604 "State compulsory standard of higher education of the Republic of Kazakhstan. Bachelor's degree. General provisions », approved by the order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 № 152 Rules for the organization of the educational process on credit learning technology (as amended and supplemented as of 28.01.2016). Standard curriculum of the educational program 6B06123 "IT IN HEALTHCARE", approved by the order of the Ministry of Education and Science of the Republic of Kazakhstan dated 05.08.2016 № 425, in accordance with the documents within the university P.01.04 / 2012 The structure of the program.

Mandatory component (GC) disciplines are included in the BP block, which is 20 credits; and optional components (OC), which is 49 credits. Modules of these disciplines allow to form a set of basic (research), subject and special competencies of the graduate.

Mandatory component (GC) disciplines are included in the block of KP, which is 5 credits; and a selection component (TC), which is 27 credits. Modules of these disciplines allow to form a set of basic and special (developmental, creative, organizational and methodological) competencies of the graduate.

Physical training - 8 credits
Experiments - 8 credits;
Final State certification - 12 credits.
Upon completion of the modular educational program, the student must master 240 credits (100%).

Goals and objectives of the modular educational program

The goal: Training of highly educated specialists with practical skills and leadership skills that meet modern requirements, design and build automated information systems in the field of IT technologies and health care.

ON 1 - to develop specialized modules of the studied CAD in medicine for carrying out strength calculations of the designed structures, to create drawings of parts and assembly drawings based on 3D models; to develop an adequate model of a system or process using modern computer tools; to be able to determine the basic electrical circuits of medical electronic devices for diagnostic and therapeutic purposes.

ON 2 - study the regulatory legal acts of the Republic of Kazakhstan in the field of information security; apply the basic standards in the field of information security; choose the main information security tools; analyze the types of attacks and threats to information security; formulate appropriate requirements for information security systems; apply modern DBMS for database processing; develop database structures taking into account the prospects of using the database; analyze and take measures to solve complex emergency situations and incidents that occur during the operation of the DBMS; apply a range of available database management tools and methods to assess the load when executing database queries.

ON 3 - create interactive elements of Web pages; interpret the basic principles of operating system design, determine the purpose, functions and their classification; analyze calculations to evaluate the effectiveness of computer and telecommunications systems and networks.

ON 4 - define the basic concepts related to information systems, as well as the collection, transmission, processing and storage of information; build a model of the information process, solve problems of optimizing the information process.

ON 5 - to create, summarize legal and economic information for use in professional, including entrepreneurial activities. Analyze, summarize economic information and systematize safety standards for use in professional activities.

ON 6 - analyze the basic theoretical and practical skills of system programming and operating systems at the level of program development, develop documentation in the artificial intelligence system and its robotics parts, determine user interaction with programs; develop and implement algorithms using the control structures of the C++ programming language; describe the basic data structures in C++.

ON 7 - describe the main theories of management in healthcare; apply effective communications in the healthcare management system.

ON 8 – interpret the results of medical and biological data in the study and diagnosis of medical examinations; be able to calculate health indicators based on situational tasks, test devices; configure, install diagnostic software.

ON 9 - apply mathematical formulas to describe the most important models, demonstrate knowledge and skills of using fundamental physical laws and theories.

ON 10 - to evaluate the possibilities of methods of encoding and compressing biomedical data in accordance with the conditions of the task; to develop algorithms for filtering and compressing information; to design protocols for information exchange in medical systems: to assess the degree of reliability of the data obtained to solve problems of evidence-based medicine; to determine the principles of designing expert systems in the field of medicine, to create programs and algorithms for expert and information-computing systems of medical orientation.

ON 11 - choose and apply the basic principles of software design; develop preliminary versions of user documentation for software; describe software components and interfaces between them, for their subsequent coding and testing.

ON 12 – principles of processing, analysis, evaluation of complexity of algorithms. Object-oriented databases, software development technology, software repair and testing, elements of error theory and mathematical processing of measurement results, fundamentals of probability theory, statistical aggregates, criteria.

ON 13 - apply the basic principles of modern information and communication technologies in the field of medicine; develop and implement modern information technologies in medicine, apply mathematical methods and modern applied software tools for processing experimental and clinical diagnostic data; apply 3D modeling and neural networks in medicine.

ON 14 - classify information systems and distinguish their characteristic features, evaluate the quality and efficiency of the use of information systems, the basics of network administration and network information systems, network administration.

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

2.Graduate competence model

- As a result of mastering the graduate of the modular educational program 6B06123 IT in healthcare should have the following competencies:
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Competencies of general education
- - use the basic structures and mechanisms of various operating systems, work with modern operating systems;
- - apply the basic concepts of system programming, develop programs covering system programming issues;
- - to design an information model of the subject area; to install, configure, use and interact with the relational database management system to represent data using various models;
- - compose SQL queries;

- - aimed at forming the ideological, civil and moral positions of the future specialist, competitive on the basis of knowledge of information and communication technologies, building communication programs in Kazakh, Russian and foreign languages, orientation to a healthy lifestyle, self-improvement and professional success;
- - form a system of general competencies that ensure the socio-cultural development of the personality of the future specialist on the basis of the formation of his ideological, civil and moral positions;
- - develop the ability to interpersonal social and professional communication in Kazakh, Russian and foreign languages;
- - contribute to the development of information literacy through the mastery and use of modern information and communication technologies in all areas of their lives and activities;
- - form skills of self-development and education throughout life;
- - form a personality capable of mobility in the modern world, critical thinking and physical self-improvement;
- - to evaluate the surrounding reality on the basis of worldview positions formed by knowledge of the fundamentals of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical cognition, to reveal the meaning of the content and specific features of the mythological, religious and scientific worldview;
- - to show a civic position based on a deep understanding and scientific analysis of the main stages, patterns, peculiarities of the historical development of Kazakhstan, to use methods and techniques of historical description to analyze the causes and consequences of events in the history of Kazakhstan;
- - assess situations in various spheres of interpersonal, social and professional communication, taking into account basic knowledge of sociology, political science, cultural studies, psychology, arguing their own assessment of everything happening in the social and industrial spheres, as well as synthesize knowledge of these sciences as a modern product of integrative processes;
- - to use scientific methods, methods of research of a specific science, as well as the entire socio-political cluster, to choose a methodology, analyze and summarize the results of the study;
- - to develop their own moral and civic position on the basis of social, business, cultural, legal and ethical norms of the Kazakh society;
- - to put into practice knowledge in the field of social sciences and humanities, which has worldwide recognition, synthesize new knowledge and present it in the form of humanitarian socially significant products;
- - to engage in communication in oral and written forms in Kazakh, Russian and foreign languages, using linguistic and speech means based on grammatical knowledge to solve problems of interpersonal, intercultural and industrial (professional) communication, as well as to analyze information, actions and deeds of communication participants in accordance with the communication situation;
- - use various types of information and communication technologies in personal activities: Internet resources, cloud and mobile services for the search, storage, processing, protection and dissemination of information;
- - to build a personal educational trajectory throughout life for self-development and career growth, to focus on a healthy lifestyle to ensure full-fledged social and professional activities through methods and means of physical culture;
- - to know and understand the basic laws of the history of Kazakhstan, the basics of philosophical, socio-political, economic and legal knowledge, communication in oral and written forms in Kazakh, Russian and foreign languages;
- - apply the acquired knowledge for effective socialization and adaptation in changing socio-cultural conditions, possess the skills of quantitative and qualitative analysis of social phenomena, processes and problems.
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- **Basic competencies:**
- - to use knowledge about the basic provisions of the theory of differential and integral calculus of functions of several variables, the theory of differential equations, the theory of series;
- - create algorithms for solving problems;

- - use methods of constructing various models of data types, algorithms for information processing; rationally - use the opportunities provided by technology;
- - algorithmization, for solving practical problems;
- - organize the necessary data structures;
- - fix program errors;
- - write programs in a good style;
- - use methods of constructing various data models, algorithms for information processing;
- - rationally use the opportunities provided by the algorithmization technique to solve practical problems;
- - formalize, factorize, normalize, decompose and structure input, intermediate, output data;
- - build mathematical models of algorithms.
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- **Professional competencies:**
- - use information computer systems in medicine and healthcare, theoretical foundations of computer science, collection, storage, search, processing, transformation, dissemination of information in healthcare, state standards on electronic medical history, as well as methods and means of protecting personal data in medical information systems, principles of automation of management of healthcare institutions using modern information technologies, algorithms and software tools to support decision-making during the therapeutic and diagnostic process and software and technical means of medical statistics used at various stages of obtaining and analyzing biomedical information.
- - work with electronic healthcare with a mobile application, carry out text and graphic processing of medical data using standard operating system tools and generally accepted office applications, as well as applied and special software tools, use statistical and heuristic algorithms, methods of obtaining knowledge from data, expert systems for the diagnosis and management of treatment of diseases;
- - to use programming languages and systems in order to automate information processes for collecting information necessary for processing and making management decisions, to work with general-purpose software, to search for information using search rules (query construction) in databases, computer networks of normative reference information;
- - apply instrumental software tools and mathematical models in the decision-making process, formulation and formalization of expert decision support tasks, analysis and interpretation of the results obtained.
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- **Special competencies:**
- - apply the theoretical foundations of obtaining, collecting, entering, storing, searching, processing, converting, distributing and protecting medical information, types and classification of modern medical information systems, the essence and main provisions of the use of modern information technologies and videoconferencing in medicine, medical science and healthcare, the current state of the level and directions of development of computer technology and software funds for use in the field of medicine;
- - to define information systems, tasks of medical information and computing systems, the functional purpose of medical information and computing systems, the concept of an automated control system in medicine, its levels, components, structure, functions, basic requirements, as well as development stages.
- - to use modern medical information and telemedicine systems for professional activity, to assess the legality, legitimacy and effectiveness of using modern medical information and telemedicine systems for professional activity, to work with software tools for solving medical problems.
- - formulate the goals and objectives of the study; plan, organize and conduct statistical observation in accordance with the tasks set; use tabular and graphical methods of presenting statistical observation materials and formulate conclusions arising from the results of statistical observation, and give a generalizing conclusion on them;

- - to develop and analyze the structure of the scheme of the software package of the automated hospital information system of the medical and preventive institution and to include information about hospitalized patients, to form consolidated and personalized accounts for mutual settlements with the medical organization of the AU in the hospital;

- - to search, store, process and analyze information from various sources and databases, to present it in the required format using information, computer and network technologies, public speech, argumentation, discussion and polemics; to expand and deepen scientific worldview; the ability to independently acquire and use new knowledge;

- - use modern computer tools to create an examination system in the clinic of internal medicine, modern software for processing experimental and clinical diagnostic data, with the introduction of new medical technologies and software and hardware complexes for the study of diseases of internal organs, computational diagnostics and methods for predicting the patient's condition.

Table 2. Mastering the disciplines of socio-professional interactionsequence

Course	Provided disciplines	Competences	Expected result
General education subjects			
Mandatory component			
1	Modern history of Kazakhstan	Socio-ethical competencies	**Must know:**socio-ethical values based on public opinion, traditions, customs, social norms and orientation to them in their professional activities; knowledge of the traditions and culture of the peoples of modern Kazakhstan. **Must be able to:** Coordination of theoretical, real-historical, source studies and historiographical aspects of the study of the history of Kazakhstan. **Skills:** Analytical and axiological analysis in the study of complex historical processes, phenomena and historical figures of modern Kazakhstan.
1	Foreign language	Competence in the field of language	**Must know:** basic definitions in the field of English, which contribute to the formation of a highly educated person with a broad field of thought and speech culture; scientific vocabulary and scientific structures of technical profile in English; rules for displaying texts of different genres; speech standards in the field of maintenance; basics of business communication. **Must be able to:**free conversation on various topics; use of reference books in English; express their views in terms of future professionals in the field of professional activity. use of reference books in English (explanatory dictionaries, reference books, encyclopedias)); **Skills:**competent interpretation in English; competent compilation of current documentation in Kazakh and English; creating a constructive dialogue; to express their opinion in English in terms of a future professional in the field of professional activity.
1	Kazakh (Russian) language	Competence in the field of language	**Must know:** basic definitions in the field of the Kazakh (Russian) language, which contribute to the formation of a highly educated person with a broad field of thought and speech culture; scientific vocabulary and scientific constructions of technical profile in the

			Kazakh (Russian) language; rules for displaying texts of different genres; speech standards in the field of maintenance; basics of business communication. **Must be able to**: - free conversation on various topics; - use of reference literature in the Kazakh (Russian) language; - to express their opinion in terms of future professionals in the field of professional activity. **Skills:**competent interpretation in the Kazakh (Russian) language; competent compilation of current documentation in the Kazakh (Russian) language; creating a constructive dialogue; to express their opinion in the Kazakh (Russian) language in terms of future professionals in the field of professional activity.
1	Information and communication technologies (in English)	Information and communication competencies	**Know:**what economic and political factors contributed to the development of information and communication technologies; features of different operating systems, architecture; **Must be able to:** Identification of key trends in the field of information and communication technologies; use of information resources for search and storage of information; work with spreadsheets, perform data grouping, create graphs; use of methods and means of information protection; designing and creating simple websites; vector and raster image processing; Creating multimedia presentations; use different platforms for communication; calculation and evaluation of performance of supercomputers; use of various forms of e-learning to expand professional knowledge; use of various cloud services. **Skills:**development of database structure; design and creation of presentations; receive data from the server; create video files; Working with smart applications; work with e-government website services.
2	Philosophy	Socio-ethical competencies	**Must know:**the main directions, problems, theories and methods of philosophy, the content of modern philosophical debates on issues of socio-philological development. **Must be able to:**to form and defend their position on various issues of philosophy; apply the rules and categories of philosophy to evaluate and analyze various social processes, facts and phenomena. Skills: public speaking, argumentation, discussion and polemics, tactical analysis of the logic of different ideas; reasoned statement of their views in writing, critical perception of information.

1	Political science	Socio-ethical competencies	**Must know:** subject and objectives of the course; - "The main content of the course" Political Science "; - mastering the basic knowledge of political theory; - The range of historical achievements in the study of ancient culture. **Must be able to:** Ability to work independently with the literature of a general humanitarian nature, to find and solve key ideological issues; ability to think logically, systematically and critically; use the baggage of philosophical erudition received to form and prove their own opinions on various issues on a daily basis; **Must master:** general education.
1	Sociology	Socio-ethical competencies	**Must know:** Laws of development and functioning of the Company; features of the analysis of the modern system of social inequality, social mobility and stratification; use of basic knowledge in the field of humanities and economics in cognitive and professional activities; **Must be able to:** Linking the basics of sociology with professional activity; apply in practice the knowledge gained in the analysis of real social situations; **Must master:** - practical skills of applying the acquired knowledge in the analysis of real social situations. - practical skills of self-analysis of the current state of society. Competence: general education.
1	Cultural Studies	Socio-ethical competencies	**Must know:** structure and composition of modern cultural studies; culturology and philosophy of culture; Sociology of Culture, Cultural Anthropology; cultural studies and cultural history; **Must be able to:** Distinguish the basic concepts of cultural studies: the dynamics of culture, symbols of language and culture, cultural codes, intercultural communication, cultural values and norms, cultural traditions, the cultural image of the world, the experience of institutions of social culture within its competence; **Must master:** General education
1	Psychology	Socio-ethical competencies	**Must know:** The essence of the basic psychological processes and properties, mental conditions that ensure the functioning of human life; be able to apply the basic methods of psychology in practice, taking into account their economic features; psychological theories of personality,

			group and team; **Must be able to:** Apply the acquired knowledge of psychology in their practice; organization of individual and group activities of people, taking into account their psychological characteristics and compatibility; competent use of communicative competence in group interaction. **Must master:** methods of memory development, thinking, information analysis and generalization;
Optional components			
1	Fundamentals of market economy and entrepreneurship / Fundamentals of law and anti-corruption culture	Socio-ethical competencies	**Must know:** monetary functions, reasons for differences in wages at the level of interest; main types of taxes; organizational and legal forms of entrepreneurship; types of securities; factors of economic growth; current state of business theory and practice; features of business activity; **Must be able to:** be able to calculate factors of production and factor income, give examples of public goods, Kazakhstani enterprises of various organizational forms, global economic problems; to be able to apply in practice the impact of the market mechanism, the main forms of incentives for wages and labor, inflation, the main items of the state budget of Kazakhstan, economic growth, the use of basic terminology of modern entrepreneurship. **Must master:** obtaining and evaluating economic information; creating a family budget; assessment of their economic activity as consumers, family members and citizens.
			Must know: As a result of studying the discipline, students should know: the essence of corruption and its causes, measures of moral and legal responsibility for corruption offenses. **Must be able to:** Acquiring new knowledge about anti-corruption culture - a whole system of interdisciplinary education. **Must master:** general education.
	Fundamentals of market economy and entrepreneurship / Fundamentals of security and life		**Must know:** monetary functions, reasons for differences in wages at the level of interest; main types of taxes; organizational and legal forms of entrepreneurship; types of securities; factors of economic growth; current state of business theory and practice; features of business activity; **Must be able to:** be able to calculate factors of production and factor income, give examples of public goods, Kazakhstani enterprises of various organizational forms, global economic problems; to be able to apply in

			practice the impact of the market mechanism, the main forms of incentives for wages and labor, inflation, the main items of the state budget of Kazakhstan, economic growth, the use of basic terminology of modern entrepreneurship. **Must master:** obtaining and evaluating economic information; creating a family budget; assessment of their economic activity as consumers, family members and citizens
			Must know:ensuring the legislative framework for life safety and environmental control, as well as methods of identification, elimination of the impact of harmful factors on man and the environment and favorable conditions for human life and activity; **Must be able to:** systematization of safety standards for use in professional activities; to choose methods of protection against hazards related to the field of their professional activity and ways to ensure favorable living conditions; **Must master:** life safety skills in industrial, domestic and emergency situations, first aid skills
Basic disciplines			
Mandatory component			
1	Physics I	Competence of natural sciences	**Must know:**Basic physical theories, laws and principles and their mathematical expressions; the ability to apply theoretical knowledge to solve specific physical problems and situations; basic laws and principles of physics; **Must be able to:** Mathematical representation of physical laws; - apply theoretical knowledge to solve specific physical problems of the situation; determine the physical nature of phenomena and processes in various devices of physical nature and perform simple technical problems related to them; work with measuring instruments, tools and instruments; graphical execution and statistical processing of data obtained during control; **Must master:** Work with measuring instruments, devices; perform statistical processing of control and measurement results and perform graphical concepts;
1	Mathematics I	Competence of natural sciences	**Must know:**Basic mathematical definitions, theorems, etc. of the course "Mathematics I". b. knowledge of theoretical data, as well as types of

			problems solved by mathematical methods; **Must be able to:** Formation of applied practical problems by mathematical methods, as well as the use of known methods to solve formulated problems; **Must master:** To improve their skills in the field of mathematical education independently or in order to meet the modern requirements of the profession;
1	Mathematics II	Competence of natural sciences	**Must know:**Properties of functions of several variables: (finite, maximum and minimum values, complex functions, individual multiplications and derivatives, complete multiplications and differentials; basic methods of integration of double and triple integrals (substitution of variables, calculation in polar coordinates); types of differential equations and methods of their solution; decomposition of functions into field series and Fourier series; basic formulas for calculating the probability of random variables; **Must be able to:**Application of methods for solving differential and integral calculus of functions of several variables in applied problems; application of methods for solving differential equations in solving applied problems; to obtain the approximate value of the solution by decomposition into a series and a Fourier series with a given accuracy; identification of optimal methods for solving practical problems; **Must master:**Solve engineering problems using mathematical methods;
1	Algorithms, data structure and programming	Professional competencies	Must know: algorithmic methods of algorithms; structural features, organization and experimental implementation of algorithms; knowledge of the basics and prospects for the development of new technologies. **Know:** These algorithms can be useful to consider the properties of algorithms and situations; creation of various programs using fundamental computational algorithms and their properties, leading to linear, branched and cyclic types of algorithms; processing arrays using different methods of internal sorting; research related to the analysis of algorithms; analysis of the effectiveness of algorithms; practical use of data models and structures, further analysis of the results. **Skills:** development of algorithms and programs for solving problems;

2	Professional Kazakh (Russian) language	Competences in the field of language	**Must know:**Scientific vocabulary and scientific structures of technical profile; rules for displaying texts of different genres; language standards in the field of maintenance; basics of business communication; **Must be able to:**Selection of language tools, the formation of opinions, taking into account the literary norms and the communicative situation; distinguish the logical and compositional structure of the scientific test, mastering oral opinions (messages, reports), analysis of public speeches; to carry out professional communication; use dictionaries and correctly interpret information about language units derived from them; issue a text read or listened to in the educational, professional, socio-cultural spheres, indicating the necessary information and describing it in a certain order; **Must master:**Work with scientific and technical literature; Independent search for scientific and technical information as a basis for professional activity; listening to and fully understanding the information presented at a moderate pace, with subsequent transmission of its content; to conduct interviews and dialogues;
3	Professionally oriented foreign language	Competences in the field of language	**Must know:**Functional features of oral and written texts of scientific and technical nature in the specialty; requirements for registration of documents accepted in professional communication; communication communication strategy in the context of professional communication; **Must be able to:**Understand speaking in a professional setting; participation in discussions on topics related to the specialty; preparation and creation of independent oral reports on professional topics using multimedia technologies; receive the necessary information from foreign language sources created in different symbol systems (text, tables, tables, diagrams, audiovisual series, etc.); annotation, abstracting and presentation in the native language of the main content of the literature on the specialty, using a dictionary, if necessary; writing messages, articles, abstracts, abstracts on professional topics. **Must master:** Basic grammatical structures of oral and written professional-oriented communication;
	Optional component		
1	Database in IS / Database concept	Professional competencies	**Must know:** various feb the structure of the information environment or information space, including the principles and methods of operation of various information systems, technical devices; **Must be able to:** classify information systems and distinguish their characteristics, assess the quality and efficiency of use of information resources, receive information from various sources, including

			undocumented, documented print and electronic sources, effectively store, process information and computer software, which is a basic component of many activities using information technology to provide it as needed for consumption. **Must master:** skills of searching for information from various sources; - analysis of relevant information, increase the efficiency of search, specify the demand for the purpose of the discipline; skills to work with modern information resources.
			Must know: - The concept of world resources; - Concepts, ideas, problems of world information systems; - The role of global information systems in the development strategy of the organization; - Features of the classification of world information systems; structure of world standard information systems; basic types of world functional information systems; **Must be able to:** - use of world information systems in educational and labor activities; **Must master:** Basic technological principles of functioning of world information resources on the basis of the global network of the Internet;
1	Operating systems/Operating systems and PC software	Professional competencies	**Must know:** Basic principles of operating systems design; The purpose, function, classification of operating systems of the discipline; principles of management of computer resources of the operating system; The concept of multiprogramming, processes and flows; Principles of virtualization and mobility of the operating system. **Must be able to:** implementation of basic algorithms for planning and synchronization of processes and flows; memory management; Disk planning; development of multi-threaded applications; take into account the specifics of the operation of specific operating systems; use of operating system tools. **skills** to install operating systems; account management; setting the parameters of the working environment; hardware configuration; Disk and file system management; -configure network settings

			Must know: basic architectural concepts and distributions of operating systems; the main components of operating systems, their purpose and interrelationships; operating systems of mainframes; server operating systems; operating systems for personal computers; - real-time operating systems. **Must be able to:** review of computer software; maintenance of operating systems; creation of system calls, system programs; choose the operating system according to the purpose and characteristics of the discipline; select the distribution of the operating system and install it on a personal computer; provide basic configuration of the operating system in the operating environment. **Must master:** - skills of solving standard problems of system programming of modern OS; -skills to work with different operating systems and their administration.
1	Basics of robotics and artificial intelligence / Robotic systems and complexes	Professional competencies	**Must master:** - skills of solving standard problems of system programming of modern OS; skills to work with different operating systems and their administration. **Mobile work.** From simple to complex. Algorithmics. Programming of mobile robots. Solving applied problems. Education of robotics. Expected result: Must know: comparative analysis and evaluation of mathematical models of automation and robotization of production processes using modern software products; It is necessary to be able to create methods of structure-oriented algorithms: design of automation and robotics systems; **Skills:** formation of modern development trends of automation and robotics systems of production processes
			The purpose of discipline: to acquaint students with the basics of robotics, to teach applications of mobile robots Content: Basics of robotics. Physical bases of robotics. Information in modulation, information processes. Basics of design. **Mobile work.** From simple to complex. Algorithmics. Programming of mobile robots. Solving applied problems. Education of robotics. Expected result: Must know: comparative analysis and evaluation of mathematical models of automation and robotization of production processes using modern software products; It is necessary to be able to create methods of structure-oriented algorithms: design of automation and robotics systems; **Skills:** formation of modern development trends of automation and robotics systems of production processes

2	Public health and health care / Social medicine	Professional competencies	**Must know;** about basic terms and concepts; On the theoretical basis of public health and public health as a scientific discipline and teaching discipline; On the history of formation and development of the discipline; The role and place of social and biological factors in the formation of health (public, group, family, individual) and in the organization of health care; On the medical aspects of ethics and deontology in the medical profession. **Must be able to:** Registration of data of patients seeking medical care in the organization of emergency medical care; **Skills:** work on the organization of processing; formation of the organization of work on collection, storage and processing of the information used in the field of professional activity
			Must know: about basic terms and concepts; On the theoretical basis of public health and public health as a scientific discipline and a discipline; On the history of formation and development of the discipline; The role and place of social and biological factors in the formation of health (public, group, family, individual) and in the organization of health care; - On the medical aspects of ethics and deontology in the medical profession. **Must be able to:** Registration of data of patients who applied to the organization for medical care; medical registration Documentation of patients receiving medical care in PPP organizations; Carrying out preliminary appointments for patients and registration of doctor's home visits; to receive unreasonable calls from the ambulance service during the working hours of the organization of emergency medical care and to transfer unreasonable calls of emergency medical care to the sites; **Skills;** Informing the population about the working hours of the clinic, the time and place of reception of the population with the chief physician, his deputies, doctors and doctors of all specialties, the scope of diagnostic
			Must know: Medical and clinical information technologies introduced in the Republic of Kazakhstan; The main issues of health automation in the Republic of Kazakhstan. The role of new technologies in medicine. basic concepts of procedural approach and programming; basic concepts and constructions of high-level programming languages; technologies for software development, methods of programming for **Must be able to:** application of the basic principles of modern information and communication technologies in the field of medicine; use of electronic document management programs and electronic management of medical projects; use of information technology in medicine; Accurate diagnosis

2	Information and communication technologies in medicine / Medical informatics	Professional competencies	and complete treatment of the patient with the help of medical devices. **Must master:** About new researches, developments and technologies in medicine. skills of analysis and selection of effective methods and technologies for automated information processing in medicine.
			Must know: theoretical foundations of medical informatics; - computer applications for medicine and health care. **Must be able to:** evidence-based medicine, automation of clinical trials; use of modern software to address the issues of management informatization in the health care system; Diagnosis, prevention, treatment and rehabilitation in the clinic of internal diseases Use of medical information systems for the purpose of the discipline. **Must master:** theory of medical informatics, as well as the practice of using modern information technology in medical and health applications.
2	Automated design systems in medicine/Production automation	Professional competencies	**Must know:** principles of software system design; organization of software design process; structural design methods; object-oriented design methods; technological tools for software development; methods of decomposition and abstraction in design; **Must be able to:** use of decomposition and abstraction methods in design; use of software development tools: development environment, project support tools, repairmen; documentation and evaluation of software product quality; design of user interfaces. **Must master:** methods and tools for the development and execution of technical documentation; methods of designing software in a structured and object-oriented approach. methods of structural and functional testing; methods of joint application development.
			Must know: principles of software system design; organization of software design process structural design methods; object-oriented design methods; technological tools for software development; methods of decomposition and abstraction in design; methods of program configuration and testing; software and data protection methods; **Must be able to:** use of decomposition and abstraction methods in design; use of software development tools: development environment, project support tools, repairmen; documentation and evaluation of software product quality; design of user interfaces. **Must master:** methods and tools for the development and execution of technical documentation; methods of designing software in a structured and object-oriented approach. methods of structural and functional testing; methods of joint application development.

2	Programming technologies / Database programming	Professional competencies	**Must know:** information, data concepts, data types, data models; concept of database, database requirements; DB data representation levels; language tools for data processing in modern DBMS. **Must be able to:** separation of data from information; description of the structure of relational database tables; support to ensure the reliability and security of data in relational databases; use SQL to create, convert and manage data in a relational database; - search, collection, processing, analysis and systematization of information in economics, management and ICT. **Must master:** practical skills of presenting information in a modern DBMS.
			Must know: information, data concepts, data types, data models; concept of database, database requirements; DB data representation levels; language tools for data processing in modern DBMS. **Must be able to:** separation of data from information; description of the structure of relational database tables; support to ensure the reliability and security of data in relational databases; use SQL to create, convert and manage data in a relational database; - search, collection, processing, analysis and systematization of information in economics, management and ICT. **Must master:** practical skills of presenting information in a modern DBMS.
2	Medical electronics/Basics of designing medical information and systems	Professional competencies	**Must know:** model classes of models and methods of modeling complex systems, Apparatus of the Monte Carlo method, the principles of modeling the processes of complex systems; methods of formalization and algorithms. **Must be able to:** research of information systems; use a systematic approach in the design and operation; development of modeling algorithms and their implementation using algorithmic languages and modeling software packages; automation, modeling of the design process;

			separation of data from information; description of the structure of relational database tables; support to ensure the reliability and security of data in relational databases; use SQL to create, convert and manage data in a relational database; - search, collection, processing, analysis and systematization of information in economics, management and ICT. **Must master:** practical skills of presenting information in a modern DBMS.
			Must know: - on the basic theories of health management; - main stages of development of management as science and art; - functions, organizational structure of health management; - basic and methods of planning in the protection system of public health; - about the essence, content, typology, methods of reception - and its acceptance algorithm; - on methods and principles of personnel management; - in medical organizations; - organizational, economic and financial - aspects of health management; - on the principles of quality management in health care. **Must be able to:** - definition of goals and formation of tasks of activity; organizations, staff of the health care system;
2	Medical electronics/Basics of designing medical information and systems	Professional competencies	**Must know:** model classes of models and methods of modeling complex systems, Apparatus of the Monte Carlo method, the principles of modeling the processes of complex systems; methods of formalization and algorithms. **Must be able to:** research of information systems; use a systematic approach in the design and operation; development of modeling algorithms and their implementation using algorithmic languages and modeling software packages; automation, modeling of the design process; **Must master:** basics of planning in the health care system; management in the health care system; basics of coordination of activities in the health care system; basics of monitoring and evaluation of results in the health care system; - design of organizational structures in health care.

			Must know: on the basic theories of health management; main stages of development of management as science and art; functions, organizational structure of health management; basic and methods of planning in the protection system of public health; about the essence, content, typology, methods of reception and its acceptance algorithm; on methods and principles of personnel management; **Must be able to:** in medical organizations; organizational, economic and financial aspects of health management; on the principles of quality management in health careassessment of external and internal environment; application of management methods; health manager services; organization of the organization's activities to provide information on public health and measures to improve the quality and effectiveness of preventive care; use of information technology in the management system; health manager's position; formation of the work plan of the organization; use of effective communications in health care management; internal motivation in the management of human resources in the medical organization. **Must master:** basics of planning in the health care system; management in the health care system; basics of coordination of activities in the health care system; basics of monitoring and evaluation of results in the health care system; - design of organizational structures in health care.
3	Medical statistics / Health system statistics	Professional competencies	**Must know:** - the essence, basic concepts, principles and methods of medical statistics, the use of statistics in solving problems in the field of public health and health care; methodology of organization of statistical control (methodology, forms, types, methods and stages of planning and statistical observation); - the essence of descriptive statistics, methods of application and calculation, the basics of analysis; registration and submission of results on the rules of statistical observation; analysis of population health indicators in the basic methods of calculation (basic demographic indicators and diseases); basic methods of calculating the performance of inpatient clinics. **Must be able to:** formulation of goals and objectives of the discipline; planning, organization and conduct of statistical control in accordance with the tasks, use of tabular and graphical methods to present the results of statistical observations; drawing conclusions about the results of statistical observations and the resulting generalized results. **Must master:** public speaking, argumentation, debate; ability to expand and deepen the scientific outlook; ability to independently acquire and use new knowledge

			Must know: the essence, basic concepts, principles and methods of medical statistics, the use of statistics in solving problems in the field of public health and health care; methodology of organization of statistical control (methodology, forms, types, methods and stages of planning and statistical observation); the essence of descriptive statistics, methods of application and calculation, the basics of analysis; registration and submission of results on the rules of statistical observation; analysis of population health indicators in the basic methods of calculation (basic demographic indicators and diseases); basic methods of calculating the performance of inpatient clinics.
			Must be able to: formulation of control tasks for the purpose of the discipline; planning, organization and conduct of statistical control in accordance with the tasks, use of tabular and graphical methods to present the results of statistical observations; drawing conclusions about the results of statistical observations and the resulting generalized results.
			Must master: public speaking, argumentation, debate; - ability to expand and deepen scientific views; ability to independently acquire and use new knowledge.
3	Software for information systems/Programming of information systems	Professional competencies	**Must know:** software interfaces and software design methods and tools. **-**DB database design methods and tools. Functional and technical design of software. Principles and types of software architecture. Methods and principles of JSC. Procedure for installation and maintenance of AIS server and client software; Basic principles and software for AIS development.
			Must be able to: Selection and application of basic principles of software design. Development of software documentation for software and database interfaces. Development of preliminary versions of software user documentation. Describe the components of the software and the interfaces between them, for their subsequent coding and testing. formation of documentation reporting on the results of work.
			Must master:. about the diversity of tools and applications, software problems and prospects for development.
			Must know: - Terminology of the discipline, technology and methods of object- oriented programming, methods of abstraction of basic data structures and their processing and implementation, basic algorithms of data processing, basic libraries of standard programs.
			Must be able to: use of programming methods in the development of information systems; determine the data structure when designing algorithms for solving problems; development of algorithms, solving complex problems in a sequence of simple problems and implementation of algorithms in a high-level programming language; use of standard program

			libraries included in the programming language. **Must master:** methods and technologies of algorithm development, description of data structure and other basic data concepts, programming in high-level language, work in different programming environments.
3	Biostatistics / Statistical analysis in health care	Professional competencies	**Must know:** - about data types and ways of their presentation; on measuring scales; agreement and compliance criteria types; study of systematic errors and their assessment; signs of the properties of the law of normal distribution; analysis of variance; correlation dependence; criteria for testing hypotheses; Student criteria; epidemiological analysis, the main criteria of epidemiological indicators; planning of medical biological experiment; about the stages on the analysis of viability. **Must be able to:** application of statistical processing methods; assessment of reliability and accuracy of measurements in biostatistics; identify differences in statistical significance; get units for the selected set; determine the distribution of statistical series, and assess their compliance with the laws of theoretical distribution. determination of assessment accuracy and reliability by reliability intervals. quantitative characteristics, capacity, size, single factor application of basic methods of analysis of variance; check the statistical hypotheses to draw the survival curve; - calculation of the selection correlation coefficient. **Must master:** Evaluation to explain the methodology of mathematical and statistical analysis, the results of research in medicine and biology.
			Must know: about data types and ways of their presentation; on measuring scales; agreement and compliance criteria; about types; study of systematic errors and their assessment; signs of the properties of the law of normal distribution; analysis of variance; correlation dependence; criteria for testing hypotheses; Student criteria; epidemiological analysis, the main criteria of epidemiological indicators; on the analysis of viability. **Must be able to:** application of statistical processing methods; assessment of reliability and accuracy of measurements in biostatistics; identify differences in statistical significance; get units for the selected set; **Must master:** Evaluation to explain the methodology of mathematical and statistical analysis, the results of research in medicine and biology.
3	Audit information security / Protection of information confidentiality	Professional competencies	**Must know:** Regulatory legal acts of the Republic of Kazakhstan in the field of JSC. Regulatory and technical documents for JSC. business continuity, registration and accounting of JSC events, backup, antivirus protection, access control, work with removable media, mobile devices, remote access, use of cryptography and their carriers, defining measures for software licenses and variants of JSC principles, methods and tools of provision. The main trends in the development of domestic and foreign

			markets for tools and instruments of JSC. basic concepts and concepts of modern information security technologies; basic methods of creating an information security system; basic standards in the field of information security; basic tools of information security; main goals and objectives of information security; features of information security objects, their classification. **Must be able to:** Documents governing the processes of JSC support (registration and accounting of JSC events, backup, antivirus protection, access control analysis of information security threats and types of attacks; formation of appropriate requirements for information security systems; **Must master:** basic skills of creating and managing information security systems; skills to demonstrate typical attacks on information systems; Basic skills of working with a security administrator of
			Must know: basic concepts and directions in the protection of computer information, principles of information protection, examples of threats to the security of computer systems and the principles of classification; **Must be able to:** Monitoring the implementation of the action plan to ensure the JSC. - Analysis of the results of verification of compliance with the requirements of the documents governing the processes of ensuring the management of civil defense processes in the JSC and the organization. - participate in the development of confidentiality agreements with employees, contractors and third parties or non-disclosure of information. - configuration of security devices installed in the operating system, analysis of computer and network environment protection using a security scanner; installation and use of one of the tools for encrypting information and organizing data exchange using an electronic digital signature; **Must master:** methods of audit of information systems security, methods of systematic analysis of information systems.
4	Programming languages / Programming in high-level language	Professional competencies	**Must know:** hierarchical, network and relational databases; basics of descriptive languages, database manipulation; General information about the design of information systems; basics of database creation; database and technical characteristics of its components; Effective methods of restoring the performance of DBMS and DB; - DB Development Strategy and the organization's database management system. **Must be able to:** conceptual, logical and physical database design; designing an information model of a specific subject area; use of modern DBMS for database processing; presentation of data by means of various models; Designing the structure of the database, taking into account the prospects for the use of the database; Take measures to analyze and resolve complex emergencies and incidents that occur during the operation of the

			DBMS; Use a range of available database management tools and methods to assess the load when fulfilling the requirements of the database; Analysis and identification of the causes of failures in the work of the DBMS, their subsequent elimination. **Must master:** skills in the creation of information applications and information systems with the use of modern DBMS on different devices on platforms in different subject areas and experimental design of DB.
			Must know: the purpose and main components of the database system Discipline, levels of data representation, basic data models used in industrial DBMS; Modern methods of database design; modern software products, modern database management systems required for the creation of databases of complex organizational systems - Theoretical bases and basic principles of database creation of information systems. **Must be able to:** development of the structure of the relational database, the creation of user applications with interactive DBMS tools; creation of complex queries and programs (scripts) for the implementation of multi-operator requests and processing of relational databases; **Must master:** methods and methodology of research on the information model of the enterprise; Modern methods of creating databases; DBMS Access 2010, creation and administration of decentralized databases with MS SQL Server utilities.
4	Modeling of information systems / Basics of computer modeling	Professional competencies	**Must know:** principles of creating analytical and simulation models of information processes; basic classes of models and methods of modeling; Methods of formalization, algorithms and implementation of models on the computer. **Must be able to:** choice of modeling method; creation of an adequate model of the system or process using modern computer tools; analysis and interpretation of modeling results. **Must master:** methods and techniques; methods and techniques of modeling information systems on modern computers on the basis of analytical-simulation approach;
			Must know: model classes of models and methods of modeling complex systems, - Apparatus of the Monte Carlo method, the principles of modeling the processes of complex systems; methods of formalization and algorithms. **Must be able to:** research of information systems; use a systematic approach in the design and operation; development of modeling algorithms and their implementation using algorithmic languages and modeling software packages; - automation, modeling of the design process; - use of the database.

			Must master: skills in using computer modeling tools to create psychological comfort for the user.
4	Health Management / Health Department	Professional competencies	**Must know:** on the basic theories of health management; main stages of development of management as science and art; on the functions and organizational structure of health management; - basic and methods of planning in the protection system of public health; about the essence, content, typology, methods of reception and its acceptance algorithm; **Must be able to:** definition of goals and formation of tasks of activity; organizations, staff of the health care system; assessment of external and internal environment; application of management methods; health manager services; organization of the organization's activities to provide information on public health and measures to improve the quality and effectiveness of preventive care; use of information technology in the management system; health manager's position; formation of the work plan of the organization **Must master:** basics of planning in the health care system; management in the health care system; basics of coordination of activities in the health care system; basics of monitoring and evaluation of results in the health care system; design of organizational structures in health care.
			Must know: on the basic theories of health management; main stages of development of management as science and art; functions, organizational structure of health management; basic and methods of planning in the protection system of public health; about the essence, content, typology, methods of reception **Must be able to:** definition of goals and formation of tasks of activity; organizations, staff of the health care system; assessment of external and internal environment; application of management methods; health manager services; organization of the organization's activities to provide information on public health and measures to improve the quality and effectiveness of preventive care; use of information technology in the management system; health manager's position; formation of the work plan of the organization; **Must master:** basics of planning in the health care system; management in the health care system; basics of coordination of activities in the health care system; basics of "results monitoring and evaluation" in the health care system; design of organizational structures in health care.
4	Web technology / Internet programming	Professional competencies	**Must know:** Basics of the World Wide Web; Stages of web-site development; HTML hypertext markup language; Technology of content distribution and decoration using cascading tables of CSS styles; Modern technologies for web-site development; the order of use of server echnologies; Principles of SEO-optimization of sites.

			Must be able to: create static HTML pages and use style sheets; -creation of interactive elements of web-pages using tools for creating static sites (Web-editor, graphic editor, etc.); Development of dynamic Web-sites using modern technologies of site design. **Must master:** Knowledge of hypertext markup language for creating HTML-documents;
			Must know: Technology of creating Web-pages using PHP; standards for the development of Internet resources, formats for storing graphic information for Internet resources, the principles of creating client and server components. **Must be able to:** Creating various Web-sites with PHP tools; development of Internet applications using modern processing tools. **Must master:** Skills in developing Web-resources with PHP tools.
Professional disciplines		
1	Medical Biophysics / Medical Physics and Medical Visualization	Professional competencies	**Must know:** modern methods for studying the structure and function of membranes; - study of surface tension forces; ionizing radiation; - dosimetry; the principle of conversion of biological and non-electrical signals into electricity; design of transducers and electrodes, their main characteristics; construction of an electrocardiograph, the principle of operation. Basic methods of ECG recording. Principle of ECG recording and analysis; construction of the electroencephalograph, the principle of operation. Basic rhythms of EEG. Principle of EEG registration and analysis; laser radiation. Use of laser beams in medicine; construction and principle of operation of spectrophotometers. Use of spectrophotometric methods to determine the concentration of a substance in biological fluids. The phenomenon of polarization in biosystems. Special methods of microscopy of biological objects. Model of moving threads. Muscle biomechanics. Hill's equation. One contraction power. Modeling of muscle contraction. Electromechanical layering. Instruments for measuring external respiratory function. Construction and principle of operation. Registration and analysis. Study of rheological properties of biological fluids. Methods of studying blood circulation. Integral and regional rheography. Indirect methods of recording pulses and minute output. Physical basis of hemodynamics. Regularities of blood flow in the venous and venous channels. Basic technical means of medical introscopy.Sources of errors in the registration of medical indications. **Must be able to:** methods of treatment with the help of complex techniques and methods of ionizing radiation; - prepares, plans and carries out equipment for radiation treatment of patients on the recommendation

			of a medical specialist; - the application of physical factors in the field of fundamental and applied research under the supervision of a medical physicist to the human body, ensuring radiation safety and quality of personnel, the use of patients in radiation should be able to identify sources of ionizing radiation
			Must master: To study the results of all types of physical phenomena and processes occurring in nature, to participate in the conduct of individual research, to apply innovative research methods. Analysis and processing of research results using modern information technology. Use of modern physical equipment and devices. Participation in the organization of information and technical seminars and scientific conferences. Understand the management of nature management and know how to apply it in practice. Excursion, educational and circle work.
			Must know: modern methods for studying the structure and function of membranes; study of surface tension forces; ionizing radiation; design of transducers and electrodes, their main characteristics; Construction of the electrocardiograph, the principle of operation. Basic methods of ECG recording. Principle of ECG recording and analysis; - Construction of the electroencephalograph, the principle of operation. Basic rhythms of EEG. Principle of EEG registration and analysis; Laser radiation. Use of laser beams in medicine; Construction and principle of operation of spectrophotometers. Use of spectrophotometric methods to determine the concentration of a substance in biological fluids. The phenomenon of polarization in biosystems. Special methods of microscopy of biological objects. Model of moving threads. Muscle biomechanics. Hill's equation. One contraction power. Modeling of muscle contraction. Electromechanical layering. Instruments for measuring external respiratory function. Construction and principle of operation. Registration and analysis. Study of rheological properties of biological fluids. Methods of studying blood circulation. Integral and regional rheography. Indirect methods of recording pulses and minute output. Physical basis of hemodynamics. Regularities of blood flow in the venous and venous channels. Basic technical means of medical introscopy.Sources of errors in the registration of medical indications.
			Must be able to: Diagnosis of patients, safe operation of equipment, the use of individual methods of treatment with the help of complex techniques and methods of ionizing radiation; The medical specialist prepares, plans

			and carries out the equipment for radiation treatment of patients on the recommendation of the doctor; - The application of physical factors in the field of fundamental and applied research under the supervision of medical physicists should be able to identify sources of ionizing radiation in the human body, the use of patients during radiation to ensure radiation safety and quality of personnel. **Must master:** To study the results of all types of physical phenomena and processes occurring in nature, to participate in the conduct of individual research, to apply innovative research methods. Analysis and processing of research results using modern information technology. Use of modern physical equipment and devices. Participation in the organization of information and technical seminars and scientific conferences. Understand the management of nature management and know how to apply it in practice. Excursion, educational and circle work. Writing and writing scientific articles and reports.
2	Modern medical information systems and telemedicine / Information systems of medical technological processes	Professional competencies	**Must know:** The essence and basic rules of use of modern information technologies and videoconferencing in medicine, medical science and health care; - Theoretical bases of obtaining, collecting, entering, storing, searching, processing, processing, disseminating and protecting medical information, classification of modern medical information systems; - Telemedicine consultation for patients; - remote biomonitoring. **Must be able to:** use of different types of modern medical information and telemedicine systems for professional activities; roviding highly qualified and timely medical care to distant patients. - Communication of specialists with hospitals, clinics, other doctors. Use and application of telecommunications for the purpose of the discipline. **Must master:** search on the Internet with basic technologies and equipment for the conversion of audio-visual and other types of biomedical information with the help of graphic, text, tabular editors and applications. - The system of using videoconferencing in health care.
			Must know: Basic principles of medical technology; The structure of technological processes in medicine; optimization of models of medical technological processes in terms of reducing the cost of their implementation. **Must be able to:** work with medical and technical equipment used in work

			with patients; **Must be able to:** work with medical and technical equipment used in work with patients;
3	Expert systems in medicine / Computational expert systems in medicine	Professional competencies	**Must know:** use of medical examination systems; medical diagnostic system; forecast system; - planned system; interpretation system. **Must be able to:** solve the problem of diagnostics, differential diagnosis, prognosis, choice of treatment strategies and tactics; definition of the expert system (ES) as a software system that uses expert knowledge to ensure highly effective solution of problems in medicine; - the use of various expert systems in medicine; **Must master:** expert knowledge to solve medical problems; The main methods of using medical information systems in the treatment and diagnostic process.
			Must know: Definition of information systems, tasks, classification of medical information systems, functional purpose of medical information systems, the concept of automated control systems in medicine, its levels, components, structure, functions, basic requirements, as well as stages of development. **Must be able to:** development and analysis of the block diagram of the software package of the automated hospital information system of the medical and preventive institution; enter information about patients treated in the hospital; formation of a consolidated and personalized account-register for mutual settlements with the medical organization of the hospital; **Must master:** modern computer tools for the creation of an expert system in the clinic of internal diseases, modern software for processing experimental and clinical-diagnostic data, skills in introducing new medical technologies and software and hardware for the study of diseases of internal organs, computational diagnostics and patient prediction.
4	Mathematical methods of evidence-based medicine / Mathematical processing of experimental data	Professional competencies	**Must master:** modern computer tools for the creation of an expert system in the clinic of internal diseases, modern software for processing experimental and clinical-diagnostic data, skills in introducing new medical technologies and software and hardware for the study of diseases of internal organs, computational diagnostics and patient prediction. **Must be able to:** development and analysis of the block diagram of the software package of the automated hospital information system of the medical and preventive institution; nter information about patients treated in the hospital; ormation of a consolidated and personalized account-

			register for mutual settlements with the medical organization of the hospital; **Must master:** modern computer tools for the creation of an expert system in the clinic of internal diseases, modern software for processing experimental and clinical-diagnostic data, skills in introducing new medical technologies and software and hardware for the study of diseases of internal organs, computational diagnostics and patient prediction.
			Must know: Definition of information systems, tasks, classification of medical information systems, functional purpose of medical information systems, the concept of automated control systems in medicine, its levels, components, structure, functions, basic requirements, as well as stages of development. **Must be able to:**development and analysis of the block diagram of the software package of the automated hospital information system of the medical and preventive institution; enter information about patients treated in the hospital; formation of a consolidated and personalized account-register for mutual settlements with the medical organization of the hospital; **Must master:** modern computer tools for the creation of an expert system in the clinic of internal diseases, modern software for processing experimental and clinical-diagnostic data, skills in introducing new medical technologies and software and hardware for the study of diseases of internal organs, computational diagnostics and patient prediction.
5	3D modeling in medicine / Graphic images in medicine and healthcare	Professional competencies	**Must know:** types of computer graphics; Basics of work in Flash Professional, tools; types of effects of vector objects; - vector text processing capabilities; **Must be able to:** Flash Professionalcreate and customize different types of animation in the program; applied reports application of basic information processing algorithms to the solution. **Must master:** Flash Professional programming skills in the middle. methods and tools; Multimedia basic methods of data creation, conversion and editing;
			Must know: basic concepts and types of computer graphics; color models used in various types of computer graphics; Algorithms and types of compression of graphic images; Basics of computer modeling; Features and scope of the studied software products; Basics of web- design. **Must be able to:** creation and processing of computer graphics in an optimal way;

			Must master: basic methods of creating and editing images in vector editors; - Ability to edit photorealistic images in raster editors.
6	Administration of information systems/Automated information processing and management systems	Professional competencies	**Must know:** Methods of solving standard problems in the field of administration of information systems and networks on the basis of information and bibliographic culture, using information and communication technologies and taking into account the basic requirements of information security; Principles of construction and architecture of information systems, protocols of information systems, hierarchy of protocols and their mode of operation, information exchange in information systems, Algorithms and routing protocols, allocation of resources in information systems, Principles and methods of database administration, standards, agreements and recommendations in the field of information systems. **Must be able to:** use of tools for solving problems in the field of administration of information systems and networks, using information and communication technologies and taking into account the basic requirements of information security, installation, configuration and identification of common forms, patterns, tools to solve these problems in the field of information systems and networks. **Must master:** knowledge of management decision-making technologies and methods of information processes for the functioning of management information systems in accordance with the requirements of the software of different levels of administrative management. - skills in the practical use of modern software and computer hardware and peripherals.
			Must know: regulatory framework for the development and execution of technical documentation; methods of designing automated information systems; standard components of automated information systems; **Must be able to:** use of tools for solving problems in the field of administration of information systems and networks, using information and communication technologies and taking into account the basic requirements of information security, installation, configuration and identification of common forms, patterns, tools to solve these problems in the field of information systems and networks. **Must master:** Methods of analysis and development of the subject area - fine ASOI; selection and verification levels of digital network architecture of integrated services, methods of evaluating the effectiveness of specific versions of integrated networks; Methods of ASOI system analysis

			interfaces.
4	Data since and neural networks in medicine. / Big data	Professional competencies	**Must know:** Theoretical foundations of the discipline within the educational program; theoretical material for database design, creation and management; - Basic principles of designing and creating a relational database using the structured language SQL; The main methods of ensuring the security of the user and the security of data transmission: Software composition and functionality for database administration; various features of the DBMS; DBMS requirements; Methods of effective recovery of DBMS and DB; Methods and principles of JSC; basic principles of database theory, data warehouse, knowledge base; - basic principles of conceptual, logical and physical modeling of data; - modern tools for database design. **Must be able to:** creation of a database and a database of spreadsheets; sorting information from the database; make inquiries; Evaluation and development of requirements for the hardware and software complex, based on the prospects for the use of databases. - Selection of the most efficient DBMS for software installation and configuration. creation of database objects and management of access to these objects in modern database management systems; Analysis and identification of the causes of failures in the DBMS, their subsequent elimination. development of regulations in case of emergency situations related to the work of the DBMS, as well as during the recovery of the database; Development of a long-term plan for the development of hardware and software to increase the performance of the DBMS; - Development of applications using the SQL language. **Must master:** knowledge of database design; relational database management; Basic methods of creating Ms SQL Server database - creation of types of demand.
			Must know: - basic concepts and methods of mathematical modeling of control systems; basics of programming and algorithms, probability theory; **Must be able to:** use standard application packages to solve ractical problems. **Must master:** skills in working with modern hardware and software; methods of creating algorithms.

Table 3. List of modules included in the educational program

№ of the module	Module name	List of disciplines included in the module	Block	Semester	Loan amount RK	control of Type	All credits for the module
M.1	Functional literacy and programming	Information and communication technologies (in English)	ЖБП / M	1	5	Exam	26
		Database in IP / Database concept	BP / E	3	5	Exam	
		Algorithms, data structure and programming	BP / M	3	5	Exam	
		Operating Systems / Operating Systems and PC Software	BP / E	3	5	Exam	
		Basics of robotics and artificial intelligence./ Robotic systems and complexes	BP / E	4	6	Exam	
M.2	Basics of bilingual literacy	Kazakh (Russian) language	ЖБП / M	1,2	10	Exam	20
		Foreign language	ЖБП / M	1,2	10	Exam	
M.3	Physics - Mathematics	Physics I	BP / M	1	4	Exam	13
		Mathematics I	BP / M	1	5	Exam	
		Mathematics II	BP / M	2	3	Exam	
		Learning experience	BP / M	2	1		
M.4	Historical and social sciences	Modern history of Kazakhstan	ЖБП / M	2	5	SE	5
M.5	Module of socio-political education	Philosophy	ЖБП / M	4	5	Exam	18
		Sociology	ЖБП / M	2	8	Exam	
		Political science	ЖБП / M	2		Exam	
		Cultural Studies	ЖБП / M	1		Exam	
		Psychology	ЖБП / M	1		Exam	
		Fundamentals of market economy and	GP / T	2	3	Exam	

		entrepreneurship / Fundamentals of law and anti-corruption culture					
		Fundamentals of market economy and entrepreneurship / Fundamentals of security and life	GP / T	2	2	Exam	
M.6	Physical education	Physical education	ЖБП / M	1,2,3,4	8	Test	8
M.7	Professional languages	Professional Kazakh (Russian) language	BP / M	3	3	Exam	6
		Professionally oriented foreign language	BP / M	4	3	Exam	
M.8	Public health and health informatization	Public Health and Health Care / Social Medicine	BP / E	4	6	Exam	18
		Healthcare Management / Healthcare Management	BP / E	7	5	Exam	
		Health informatization / Health information resources	KP / E	5	5	Exam	
		Work experience I	BP / M	4	2		
M.9	Information and communication technologies in medicine	Information and communication technologies in medicine / Medical informatics	BP / E	4	6	Exam	15
		Mathematical methods of evidence-based medicine / Mathematical processing of experimental data	KP / E	7	4	Exam	
		Methods of processing medical information / Software for processing medical data	KP / E	8	5	Exam	
M.10	Management of modern automated equipment in health care	Automated design systems in medicine / Production automation	BP / E	5	5	Exam	14
		Modeling of information systems / Basics of computer modeling	BP / E	7	5	Exam	
		3D modeling in medicine / Graphic images in medicine and healthcare	KP / E	7	4	Exam	
M.11	Database management systems and IS protection	Programming technologies / Database programming	BP / E	5	5	Exam	22
		Information Systems Software / Information Systems Programming	BP / E	6	6	Exam	
		Audit information security / Protection of information confidentiality	BP / E	6	6	Exam	
		Web technology / Internet programming	BP / E	7	3	Exam	
		Work experience II	BP / M	6	2	Test	
M.12	Management of modern automated equipment in health care	Medical electronics / Basics of designing devices and systems for medical purposes	BP / E	5	5		15
		Modern medical information systems and telemedicine / Medical information systems of technological processes	KP / E	6	5	Exam	

		Expert systems in medicine / Information and computational expert systems in medicine	KP / E	7	5	Exam	
M.13	Statistical systems in health care	Medical statistics / Health system statistics	BP / E	5	5	Exam	15
		Biostatistics / Statistical analysis in health care	BP / E	6	5	Exam	
		Medical Biophysics / Medical Physics and Medical Visualization	KP / E	3	5	Exam	
M.14	Modern IT technologies in medicine	Data since and neural networks in medicine / big Data	BP / E	6	6	Exam	28
		Fundamentals of information systems	KP / M	3	5	Exam	
		Industrial practice III	KP / M	8	5	Test	
		Pre-graduate practice	KP / M	8	3	Test	
		Administration of information systems / automated information processing and management systems	KP / E	7	4	Exam	
		Data since and neural networks in medicine / big Data	KP / E	8	5	Exam	