

ALIKHAN BOKEIKHAN UNIVERSITY
Faculty of Information Technology and Economics
Department of “Information and technical Sciences»

CATALOGUE OF ELECTIVE COURSES

6B06123 IT IN HEALTHCARE

Year of admission – 2022

Semey, year 2022

Considered and approved at the meeting of educational-methodic Council of the faculty
Minutes № _____ from «__» _____ 20__ y.
The head of EMC of the faculty _____ Shoibakova E.O.

Approved at the meeting of EMC of the University

Minutes № _____ from «__» _____ 20__ y.
The chairman of EMC of the University _____ Zharykbasova K.S.

Adviser _____ Mukasheva G.E.

Awarded degree: bachelor in the field of information and communication technologies in the educational program 6B06123 "IT IN HEALTHCARE"

Elective course №	The name of subject		Prerequisites	Postrequisites	Short description of the content, the aims of education, expected results
BASIC DISCIPLINES					
Components of choice (KV)					
1	Databases in IP	5	School Computer science course	Database administration in the MS SQL Server platform, Information and communication technologies in medicine, Industrial practice I	<p>Purpose: to teach students knowledge, skills, skills of working with modern relational database management systems; application of knowledge in further professional activities.</p> <p>Content: Systems using databases. Databases and database management system. Relational algebra and relational calculus. SQL and QBE query languages. Trends in the development of database theory. Application of databases in science, technology and business.</p> <p>Expected result:</p> <p>To know: the basic concepts of the relational data model; the internal organization of modern multi-user DBMS; the basics of the relational database language SQL; database design technology at the conceptual and logical levels of data manipulation languages (QBE, DML SQL), basic functions and typical organization of database management systems (DBMS).</p> <p>Be able to: build a logical and physical model of the projected database; design databases in various DBMS and program work with them; create reports, forms, queries; conduct multidimensional data analysis; organize the user interface.</p> <p>Own: build a logical and physical model of the projected database; design databases in various DBMS and program work with them; create reports, forms, queries; perform multidimensional data analysis, implement queries for sampling, insertion, deletion, correction of records in tables.</p>
1	Database concept	2	School Computer science course	Database administration in the MS SQL Server platform, Medical Informatics, Industrial practice I	<p>Purpose: to study and practice the methods of the database concept (DB) and the general principles of their functioning, theoretical and applied issues of the application of modern database management systems (DBMS) and automated information systems (AIS).</p> <p>Contents: Basic concepts of database theory. A data bank as an information system. Database typology. Transaction processing systems. Data integrity and security. Information repositories. Object-oriented databases. Distributed databases and client-server systems.</p> <p>Expected result:</p> <p>To know: about the principles of organization and architecture of database systems; data models; sequence and stages of database design; modern methods of synthesis and optimization of database structures; - basic concepts of the data processing language (SQL); modern methods of ensuring data integrity; methods of physical organization of</p>

					<p>databases; trends and prospects for the development of modern management systems databases; about the main unsolved problems that arise during the creation and use of databases.</p> <p>Be able to: apply modern methodology for research and synthesis of information models of AIS subject areas; apply modern methodology at the stage of technical design examination, selection and system justification of design decisions on the structure of information models and databases; design databases (from the stage of analysis of the subject area of an information system to the implementation of a physical database model); apply design methods databases and database interaction programming; implement and document database-based AIS.</p> <p>Possess: work with relational databases in SQL; work on database design: analyzing the subject area of an information system, compiling an infological model and a datalogical (conceptual) database schema, determining integrity restrictions and data access rights, using data protection tools; using the "essence of communication" method (ER-method, method "entity-relation") for database design.</p>
2	Operating systems	5	Information and communication technologies (in English)	Programming technology, Computer-aided design systems in medicine, Industrial practice I	<p>Purpose: to train highly qualified specialists who have the skills to use modern operating systems in the professional field. Operating systems provide abstraction and manage the resources of hardware devices shared by computer users. The titles of this discipline reveal the basic knowledge concerning the interaction of the operating system with the hardware of a computer system and networks, describes the operation in kernel and user modes, and also provides basic approaches to the design and development of operating systems.</p> <p>Contents: Fundamentals of design, operation and use of operating systems (OS), their architectures and applied algorithms. Familiarity with modern OS: MS Windows, Unix-type OS (FreeBSD, Linux), macOS, real-time OS, mobile OS (Android, iOS), embedded OS.</p> <p>Expected result:</p> <p>To know: basic principles of operating system design; purpose, function, classification of operating systems; principles of operating system computing resources management; the concept of multiprogramming, processes and threads; principles of virtualization and mobility of the operating system.</p> <p>Be able to: implement basic algorithms for planning and synchronizing processes and threads; manage memory; plan disk scheduling; edit multithreaded applications; take into account the specifics of working in specific operating systems; use operating system tools.</p> <p>Possess: the skills of installing operating systems; account management; settings of working environment parameters; configure hardware; disk and file system management; network settings.</p>
	PC operating systems and Software	5	Information and communication technologies (in English)	Database programming, Production Automation, Production	<p>Purpose: To teach knowledge and skills of using modern software, to gain knowledge about modern operating systems, their functional architecture, the resources and methods implemented by them, and resource management of computer complexes. To</p>

2				practice I	<p>teach knowledge and skills in the use of modern software, to familiarize with effective algorithms for solving various scientific and technical problems.</p> <p>Contents: General information about operating systems. History of operating systems. The architecture of the operating system. The main functions of the OS. Processes and threads. Memory management. File systems. Input and output control. Architectural features of the micro-process model of the weed system. Real memory management. Configuring network parameters and sharing resources in local networks.</p> <p>Expected result:</p> <p>To know: the basic architectural concepts of building and distributions of operating systems; the main components of operating systems, their purpose and relationship; mainframe operating systems; server operating systems; operating systems for personal computers; real-time operating systems.</p> <p>Be able to: review computer software; provide operating system service; create system calls, system programs; select the operating system according to its purpose and characteristics; select the operating system distribution and install it on a personal computer; provide basic configuration of the operating system in the environment of its functioning.</p> <p>Possess: skills of solving typical tasks of system programming of modern operating systems; skills of working with various operating systems and their administration, solving practical tasks to support the operation of the OS.</p>
3	Fundamentals of robotics and artificial intelligence	6	Algorithms, data structures and programming	Expert systems in medicine, Data science and neural networks in medicine	<p>Purpose: to familiarize students with the basics of robotics, training programs for mobile robots</p> <p>Contents: Fundamentals of robotics. Physical fundamentals of robotics. Information in modeling, information processes. Fundamentals of design. Mobile work. From simple to complex. Algorithmization. Programming of mobile robots. Solving applied problems. Educational robotics.</p> <p>Expected result:</p> <p>To know: methods of comparative analysis and evaluation of mathematical models of automation systems and robotization of production processes using modern data software products; methods of constructing algorithms aimed at the structure.</p> <p>Be able to: design automation and robotics systems; comparative analysis with the use of modern software products for the robotization of technological complexes and automation systems of production processes in various industries, as well as artificial intelligence methods.</p> <p>Own: formation of modern trends in the development of robotics systems and automation of production processes</p>
3	Robotic systems and complexes	6	Algorithms, data structures and programming	Information and computing expert systems in medicine, Big data	<p>Purpose: to develop the ability to creative self-realization through the development of design skills in the process of creating robotic systems.</p> <p>Contents: Robot actuators. Computing devices in the control system of robots and flexible production modules. Software control systems for industrial</p>

					<p>robots. Adaptive robot control systems. Robot sensitivity systems. Remotely controlled robots and manipulators. Solving software problems of the application of robotic systems.</p> <p>Expected result: Know: industrial robot control systems; about remotely controlled robots.</p> <p>Be able to: use robotic systems training in solving programming problems.</p> <p>Possess: information processing; organization of work on the collection, storage and processing of information used in the field of professional activity.</p>
4	Public health and healthcare	6	Fundamentals of information systems	Informatization of healthcare, Medical statistics	<p>Purpose: Formation of opportunities for a specialist doctor to apply the basic principles of the organization of prevention, medical care and personnel management in the activities of medical organizations and their structural divisions.</p> <p>Content: Unified National Health Information System of Kazakhstan. The concept of e-health development of the Republic of Kazakhstan. Objects and subjects of informatization in the field of healthcare. Principles of informatization in the field of healthcare. Ensuring the protection of personal data of individuals (patients).</p> <p>Expected result: To know: about the basic terms and concepts; about the theoretical basis of public health and healthcare as a scientific discipline and subject of teaching (tasks, subjects, methods, principles); about the history of the formation and development of the discipline; about the role and place of social and biological factors in the formation of health (public, group, family, individual) and organization about medical aspects of ethics and deontology in the activities of a doctor.</p> <p>Be able to: register the data of patients who have applied for medical care to the organization of primary health care; draw up medical documentation of patients receiving medical care in the organization of primary health care; make a preliminary appointment of patients for an appointment with doctors; make house calls to doctors; receive unreasonable calls from the ambulance service during the hours of the organization of primary health care and transfer unreasonable calls for emergency medical care science; inform the population about the order of work of the polyclinic, about the time and place of reception of the population by the chief physician, his deputies, doctors and all specialties, about the volume of diagnostic studies in the polyclinic.</p> <p>To own: to form a register of the attached population, including in electronic format; to carry out the selection and delivery of medical documentation to doctors' offices; to ensure proper management and storage of the card file to regulate the intensity of the population flow in order to create a uniform load of doctors.</p>
4	Social Medicine	6	Fundamentals of information systems	Health information resources, Health system	<p>Purpose: Formation of opportunities for a specialist doctor to apply the basic principles of the organization of prevention, medical care and personnel management in the activities of medical</p>

				statistics	<p>organizations and their structural divisions.</p> <p>Content: Unified National Health Information System of Kazakhstan. The concept of e-health development of the Republic of Kazakhstan. Objects and subjects of informatization in the field of healthcare. Principles of informatization in the field of healthcare. Ensuring the protection of personal data of individuals (patients).</p> <p>Expected result:</p> <p>To know: about the basic terms and concepts; about the theoretical basis of public health and healthcare as a scientific discipline and subject of teaching (tasks, subjects, methods, principles); about the history of the formation and development of the discipline; about the role and place of social and biological factors in the formation of health (public, group, family, individual) and health organization; about medical aspects of ethics and deontology in the activity of a doctor</p> <p>Be able to.to register the data of patients who have applied for medical care in the organization of primary health care; to draw up medical documentation of patients receiving medical care in the organization of primary health care; to make a preliminary appointment of patients for an appointment with doctors; to receive calls from doctors at home; to receive unreasonable calls from the ambulance service during the opening hours of the organization of primary health care and to transmit unreasonable calls for emergency medical care to scientists; inform the population about the order of work of the polyclinic, about the time and place of reception of the population by the chief physician, his deputies, doctors of all specialties, about the scope of diagnostic studies in the polyclinic.</p> <p>To own: to form a register of the attached population, including in electronic format; to carry out the selection and delivery of medical documentation to doctors' offices; to ensure proper management and storage of the card file to regulate the intensity of the population flow in order to create a uniform load of doctors.</p>
5	Information and communication technologies in medicine	6	Information and communication technologies (in English), Databases in IS, Medical physics	Information systems software, 3D modeling in medicine, Industrial practice II	<p>Purpose: The use of ICT in domestic medicine is to form a unified state system in the field of healthcare, which will include both information and technical means.</p> <p>Contents: General principles of formation and development of information and communication systems in the social sphere and healthcare of Kazakhstan and foreign countries: comparative analysis. Features of health management, personal health cabinet with the use of information and communication technologies.</p> <p>Expected results:</p> <p>To know: medical and clinical information technologies implemented in the Republic of Kazakhstan; the main problems of automation of health protection in the Republic of Kazakhstan; the role of new technologies in medicine; procedural approach and basic programming concepts; basic concepts and constructions of high-level programming languages; software development</p>

					<p>technologies for the healthcare sector, programming methods.</p> <p>Be able to: use the basic principles of modern information and communication technologies in the field of medicine; use electronic document management programs and electronic project management in medicine; apply information technology in medicine; establish an accurate diagnosis using medical devices and completely cure the patient.</p> <p>Possess: about the latest research, developments and technologies in medicine; skills of analysis and selection of optimal methods and technologies of automated information processing in medicine.</p>
5	Medical Informatics	6	Information and communication technologies (in English), Database concept, Medical physics and medical visualization	Programming of information systems, Graphic images in medicine and healthcare, Industrial practice II	<p>Objective: Optimization of information processes in medicine through the use of computer technologies, ensuring an increase in the quality of protection.</p> <p>Contents: Introduction to medical informatics. Modeling in biology and medicine. Statistical analysis of biomedical data. Medical information systems in the medical and diagnostic process.</p> <p>Expected results:</p> <p>To know: theoretical foundations of medical informatics; computer applications for solving problems of medicine and healthcare.</p> <p>Be able to: use modern software tools to solve problems of evidence-based medicine, automation of clinical trials, informatization of management in the healthcare system; use a medical information system for diagnosis, prevention, treatment and rehabilitation in the clinic of internal diseases.</p> <p>Possess: the theory of medical informatics, as well as the practice of applying modern information technologies in the application to medicine and healthcare.</p>
6	Computer-aided design systems in medicine	5	Operating systems	Modern medical information systems and telemedicine, Healthcare Management	<p>Purpose: Professional development and knowledge on the development and application of computer-aided design and production systems, the possibilities and widespread use of computer-aided design systems, automation of work at the stages of design and pre-production of IPR in the life cycle of industrial products, design and drawings using computers.</p> <p>Content: Computer-aided design systems in modern production. Ways of organizing the design of an automated enterprise system. Composition and structure of the PLAN. Computer-aided design (CAD) system. Goals and objectives of creation. The structure and content of the CAD creation process. CAD software. Information support of IP. Linguistic support of CAD. Methods for determining the hardware reliability of CAD. Local computer networks CAD. Special AutoCAD software tools for the design of automated systems.</p> <p>Expected result:</p> <p>To know: the composition, structure and types of CAD software; the possibilities of automating the design process; the basics of computer-aided design systems in the development of production layouts; organization of work on computer-aided design; classification of computer-aided design and production systems; composition, structure of</p>

					<p>computer-aided design and production systems; modern CAD systems, their capabilities in the design of devices; CAD/CAM/CAE-systems of SolidWorks, Autodesk Inventor, KOMPASAskon; interaction with the database and knowledge base of automatic design systems; basic principles of operation in a wide range of CAD software products.</p> <p>Be able to: edit texts in AUTOCAD, use presentation management tools, work with splines, apply 3D-Orbit mode and create typical three-dimensional objects, apply editing orders; use computer-aided design systems at all stages of design; create drawings of parts and assembly drawings, assembly parametric drawings; customize the interface for specific user purposes; apply studied techniques and methods for creating drawings; create 3D models, parametric 3D models of parts; create 3D assemblies, parametric 3D assemblies; create drawings of parts and assembly drawings based on 3D models; use specialized modules of the CAD system under study to carry out strength calculations of the designed ones. structures.</p> <p>Possess: the capabilities of modern CAD application software packages; the AutoCAD graphic editor; use automation tools in technological calculations; skills in using the capabilities of modern computers and information technologies in computer modeling.</p>
6	Automation of production	5	PC operating systems and Software	Information systems of medical technological processes, Management in healthcare	<p>Purpose: To form basic knowledge and skills in automation, ideas about modern automated production; formation of students' knowledge and skills necessary for a future bachelor of technological education.</p> <p>Contents: General concepts of automation. Production and technological processes in mechanical engineering. Automation of production. Automation of control and control in the production of machines. Automatic control systems.</p> <p>Expected result:</p> <p>To know: the purpose, classification, device and principle of operation of automation tools in production; the general composition and structure of computers, technical and software tools for implementing information processes, technology of automated information processing, local and global networks.</p> <p>Be able to: analyze the readings of control and measuring devices; make an informed choice of equipment, means of mechanization and automation in professional activities.</p> <p>Possess: skills in solving automation problems, choosing methods and automation tools; software for the development of automated technological processes.</p>
7	Programming technology	5	Algorithms, data structures and programming, Operating systems	Programming languages	<p>Purpose: "Programming Technology" is to teach students a systematic understanding of the principles of building and designing software systems. Familiarization with the methods of analysis, design, implementation and testing of software systems necessary for software development, as well as familiarization with</p>

					<p>existing, existing principles and technologies.</p> <p>Content: High-level programming methodology. Standard tasks and typical examples from the practice of programming technology. Solving computational and programming problems.</p> <p>Expected result:</p> <p>Know: principles of software system design; organization of software design process; methodology of structural software design; methodology of object-oriented software design; technological tools for software development; methods of decomposition and abstraction in software design; methods of program and data protection;</p> <p>Be able to: use decomposition and abstraction methods in software design; use software development tools: development tool environments, project support tools, debuggers; document and evaluate the quality of software products; design user interfaces.</p> <p>Possess: methods and tools for the development and execution of technical documentation; methods of software design with a structural and object-oriented approach; methods of structural and functional testing; methods of joint application development.</p>
7	Database programming	5	Algorithms, data structures and programming, Operating systems and PC software	Programming in a high-level language	<p>Purpose: To study the techniques of database design used in the development of information systems used in various fields of economic activity; mastering the theoretical foundations of database construction.</p> <p>Contents: Basic concepts of database theory. A data bank as an information system. Database typology. Transaction processing systems. Data integrity and security. Information repositories. Object-oriented databases. Distributed databases and client-server systems. Promising database models. Publishing databases on the Internet. Modern DBMS and their application. Organization of data warehouses.</p> <p>Expected result:</p> <p>To know: the concept of information, data, data types, data models; the concept of databases, database requirements; levels of data representation in the database; language means of data processing in modern DBMS.</p> <p>Be able to: distinguish data from information; describe the structure of relational database tables; maintain the reliability and safety of data in a relational database; use the SQL language to create, modify and manage data in relational databases; search, collect, process, analyze and systematize information in economics, management and ICT.</p> <p>Possess: practical skills of presenting information in modern DBMS.</p>
8	Medical Electronics	5	Physics 1, Medical Physics	Biostatistics	<p>Purpose: Students acquire knowledge about modern computer technologies for their use in the design of medical equipment.</p> <p>Contents: Electrical measurements in medicine. Electrodes and microelectrodes. Resistive sensors. Semiconductor photo converters. Thermoelectric converters. Piezoelectric converters. Functional nodes of electronic medical devices. Structure and</p>

					<p>circuitry of diagnostic and therapeutic devices.</p> <p>Expected results:</p> <p>To know: 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.</p> <p>Be able to: use various types of modern medical information and telemedicine systems for professional activities, assess the legality, legitimacy and effectiveness of using modern medical information and telemedicine systems for professional activities, work with software tools for solving medical problems.</p> <p>Possess: terminology related to modern computer technologies applied to solving problems of medicine and healthcare; the ability to search, store, process and analyze information from various sources and databases, present it in the required format using information, computer and network technologies.</p>
8	Fundamentals of designing medical devices and systems	5	Physics 1, Medical Physics and Medical Imaging	Statistical analysis in healthcare	<p>Purpose: To form knowledge about the use of computer technology in medicine, computer technology in medicine.</p> <p>Contents: Functional components of electronic medical devices. Structure and circuitry of diagnostic and therapeutic devices. Application software for automated diagnostic, therapeutic and laboratory systems and complexes. Examples of practical implementation of computer technologies in biomedical research.</p> <p>Expected result:</p> <p>Know: how to search, store, process and analyze information from various sources and databases, present it in the required format using information, computer and network technologies;</p> <p>Be able to: search, store, process and analyze information from various sources and databases, present it in the required format using information, computer and network technologies;</p> <p>Own: the ability to search, store, process and analyze information from various sources and databases, present it in the required format using information, computer and network technologies.</p>
9	Medical statistics	5	Mathematics II, Public Health and Healthcare,	Biostatistics	<p>Purpose:To acquire knowledge, skills and abilities of statistical data analysis, principles of adequate selection and application of statistical methods, interpretation of their results for decision-making in the field of public health and healthcare using computer statistical programs.</p> <p>Contents: Fundamentals of sanitary statistics. Statistics of population health and natural movement of the population. Health indicators of the population. Performance indicators of a doctor and a medical organization.</p> <p>Expected result:</p> <p>To know: about the essence, basic concepts,</p>

					<p>principles and methods of medical statistics, in the field of application of statistics in solving problems of public health and healthcare; about the methodology, planning and organization of statistical observation (forms, types, methods and stages of statistical observation); about the essence, application, calculation methods and fundamentals of analysis of descriptive statistics; about the rules of registration and presentation of the results of statistical observation; about the basic methods of calculating the health indicators of the population (basic demographic indicators and morbidity); about the main methods of calculating the performance indicators of outpatient clinics and hospitals.</p> <p>Be able to: 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; formulate conclusions arising from the results of statistical observation and give a generalizing conclusion on them.</p> <p>Possess: public speech, argumentation, discussion and polemics; the ability to expand and deepen the scientific worldview; the ability to independently acquire and use new knowledge.</p>
9	Health system statistics	5	Mathematics II, Social Medicine	Statistical analysis in healthcare	<p>Purpose: improvement in the issues of statistical information, the use of computer technology in healthcare management.</p> <p>Contents: Fundamentals of sanitary statistics. Statistics of population health and natural movement of the population. Health indicators of the population. Performance indicators of a doctor and a medical organization.</p> <p>Expected result:</p> <p>To know: about the essence, basic concepts, principles and methods of medical statistics, in the field of application of statistics in solving problems of public health and healthcare; about the methodology, planning and organization of statistical observation (forms, types, methods and stages of statistical observation); about the essence, application, calculation methods and fundamentals of analysis of descriptive statistics; about the rules of registration and presentation of the results of statistical observation; about the basic methods of calculating the health indicators of the population (basic demographic indicators and morbidity); about the main methods of calculating the performance indicators of outpatient clinics and hospitals.</p> <p>Be able to: 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; formulate conclusions arising from the results of statistical observation and give a generalizing conclusion on them.</p> <p>Possess: public speech, argumentation, discussion and polemics; the ability to expand and deepen the scientific worldview; the ability to independently</p>

					acquire and use new knowledge.
10	Information systems software	5	Fundamentals of information systems, Information and communication technologies in medicine	Modeling of information systems, Web technologies, Audit information security	<p>Purpose: Personal computer software, the study of the processes of PC computers, the development of their algorithmization.</p> <p>Content: Client-server architecture. Providers and their systems. Principles of the organization of the Internet. Fundamentals of Web technologies: fundamentals of building computer systems. Classification of computer networks. Internet Explorer is a browser for WWW. Managing Web browsing. Object methods and object properties. Managing the flow of calculations. The PHP programming language. Installing a local PHP and ARASNE server. Settings and output to the PHP screen.</p> <p>Expected results:</p> <p>To know: methods and means of software design and software interfaces; methods and means of database design; functional and technical software design; principles and types of software architecture construction; methods and principles of information security; installation and maintenance of server and client software in AIS; basic principles and software development tools of AIS.</p> <p>Be able to: choose and apply the basic principles of software design; develop documentation of software and database software interfaces; develop preliminary versions of software user documentation; describe software components and interfaces between them, for their subsequent coding and testing; generate documentation reports on the results of the work carried out; install, adapt, maintain and operate standard AIS software.</p> <p>Own: about the variety of instrumental and applied software tools, problems and prospects of software development.</p>
10	Programming of information systems	5	Fundamentals of information systems, Medical Informatics	Fundamentals of computer modeling, Programming on the Internet, Protection of information privacy	<p>Purpose: Students study various programming paradigms, modern languages and programming methods. The main paradigms studied for this course are structural (modular), object-oriented and visual programming; the development of students' ability to independently develop algorithms and make programs for solving applied problems, using the most suitable programming languages and methods for this task.</p> <p>Contents: Fundamentals of algorithmization. Programming languages. Data types and structures. Complex and composite data structures. Programming in C/C++. The concept of code optimization. Development of a graphical interface. Introduction to MySQL. SQL commands.</p> <p>Expected result:</p> <p>To know: terminology of the discipline, methods and technology of object-oriented programming, abstractions of basic data structures and methods of their processing and implementation, basic data processing algorithms, basic libraries of standard programs.</p> <p>Be able to: apply programming methods in the development of information systems, determine data structures when designing algorithms in the process of solving problems, develop algorithms, break down the solution of a complex problem into</p>

					<p>a sequence of simpler tasks and implement algorithms in a high-level programming language; use libraries of standard programs that are included in the programming language.</p> <p>Possess: methods and technologies for developing algorithms, describing data structures and other basic data representations, programming in a high-level language, working in various programming environments.</p>
11	Biostatistics	5	Medical electronics, Medical Statistics	Mathematical methods of evidence-based medicine	<p>Purpose: To introduce and expand the knowledge of bachelors about the use of statistical methods necessary for biological research with a biological education.</p> <p>Contents: History of biostatistics. Biometric research and the modern concept of evidence-based biomedicine. Planning of scientific research. Data types. Testing statistical hypotheses. Selection of statistical criteria Variance analysis. Correlation analysis. Epidemiologyechky analysis. Survival analysis.</p> <p>Expected result:</p> <p>To know: about the types of data and ways of their presentation; about the changing scales; about the criteria of compliance and consent; about the types of systematic errors and their evaluation in research; about the properties of the law of normal distribution of signs; about the analysis of variance; about correlation dependence; about the criteria for testing hypotheses; about the Student's t-criteria; about the main criteria of epidemiological analysis, epidemiological indicators; about the stages of a medical and biological experiment, planning; about the analysis of survival.</p> <p>Be able to: apply statistical processing methods; assess the reliability and reliability of measurements in biostatistics; identify differences in statistical significance; obtain units for the selected set; determine the distribution of statistical series, and assess their compliance with the laws of theoretical distribution. determination of the accuracy and reliability of the assessment by time intervals. quantitative characteristics, power, size, one-factor application of basic methods of variance analysis; construction of the viability curve verification of statistical assumptions; correlation sampling coefficient.</p> <p>Possess: assessment for the interpretation of the methodology of mathematical and statistical analysis, research of the results of medicine and biology; apply statistical methods of data processing.</p>
11	Statistical analysis in healthcare	5	Fundamentals of the design of medical devices and systems, Statistics of the healthcare system	Mathematical processing of experimental data	<p>Purpose: to give an idea of the use of computer research methods on the example of the use of the method of molecular dynamics, taking into account the specifics of its use by specialists with a biological education.</p> <p>Contents: Introduction. History of biostatistics. Biometric research and the modern concept of evidence-based biomedicine. Planning of scientific research. Data types. Testing statistical hypotheses. Selection of statistical criteria Variance analysis. Correlation analysis. Epidemiological analysis. Survival analysis.</p>

					<p>Expected result: To know: about the properties of the law of the normal distribution of signs; about the analysis of variance; about the correlation dependence on the main criteria of epidemiological analysis, epidemiological indicators; about the stages of medical and biological experiment, planning; about the analysis of survival. Be able to: identify differences in statistical significance; obtain units for the selected set; determine the evaluation of the distribution of statistical series, and assess their compliance with the laws of theoretical distribution. determination of the accuracy and reliability of the assessment by time intervals. quantitative characteristics, power, size, one-factor application of the basic methods of variance analysis; construction of the viability curve verification of statistical assumptions; correlation sampling coefficient. Possess: apply statistical methods of data processing; assessment for the interpretation of the methodology of mathematical and statistical analysis, research results of medicine and biology;</p>
12	Audit information security	5	Information systems software	Administration of information systems	<p>Purpose: To familiarize students with the trend of information security development, with models of possible threats, terminology and basic concepts of information security theory. Content: Basic issues of information security management. Process approach. The field of activity of the ISMS. The role structure of the ISMS. The policy of the ISMS. Riskology of IB. The main processes of the ISMS. Mandatory ISMS documentation. Implementation of the developed processes. Document "Statement of Applicability". The process of "Ensuring business continuity". Ensuring compliance with the requirements of the legislation of the Republic of Kazakhstan. Operation and independent audit of the ISMS. IB audit software tools. Expected result: To know: regulatory legal acts of the Republic of Kazakhstan in the field of information security: regulatory and technical documents on information security: principles, methods and means of ensuring information security in determining business continuity measures, registration and accounting of information security events, backup, antivirus protection, access control, work with removable media, mobile devices, remote access, using cryptography and their carriers, licenses and software versioning; the main trends in the development of the domestic and foreign market of tools and means of providing information security; basic concepts and concepts of modern information security technologies; basic methods of creating information security systems; basic standards in the field of information security; basic information security tools; main goals and objectives of information protection; features of information security objects, their classification. Be able to: develop coordination of work on (updating) documents regulating the processes of information security (registration and accounting of</p>

					<p>information security events, backup, antivirus protection, access control, information security when working with removable media, mobile devices, postal services and the Internet, responding to information security incidents, the use of cryptography and their media, management licenses and software versioning); analyze types of attacks and threats to information security; formulate appropriate requirements for information security systems; use information security tools; use information security tools for functional optimization of information systems.</p> <p>Possess: basic skills of building and managing information security systems; skills of repelling typical attacks on information systems; basic skills of working as a computer system security administrator.</p>
12	Protecting the privacy of information	5	Programming of information systems	Automated information processing and management systems	<p>Purpose: To provide students with the necessary knowledge, skills and abilities in the field of modern information technologies currently used, as well as information security.</p> <p>Content: Information protection in computing systems multilevel protection of corporate networks; information protection in networks; requirements for information protection systems</p> <p>Expected result:</p> <p>To know: the methodology for evaluating the results of the application of organizational and technical solutions to ensure information security; the methodology for monitoring the implementation of plans and measures to control the processes of managing and ensuring information security of the organization; basic concepts and directions in the protection of computer information, principles of information protection, principles of classification and examples of security threats to computer systems;</p> <p>Be able to: monitor the implementation of an information security plan; analyze the results of inspections of compliance with the requirements of documents regulating the processes of information security and NTD of information security management processes in the organization; participate in the development of confidentiality or non-disclosure agreements with employees of the organization, contractors and third parties; configure built-in security tools in the operating system, analyze computer security and the network environment using a security scanner; install and use one of the means for encrypting information and organizing data exchange using an electronic digital signature;</p> <p>Possess: methods of auditing the security of information systems, methods of system analysis of information systems.</p>
13	Programming languages	6	Database administration in the MS SQL platform, Programming technology	Modeling of information systems	<p>Purpose: To review the basics of building programming languages and methods, to study the basic types and structures of data and algorithms for their processing, to teach students the basics of programming based on the C++ programming language.</p> <p>Contents: Programming in C Syntax and programming constructs of Visual C Principles of</p>

				<p>OOP Fundamentals of application programming. The structure of the executable module. Dynamic placement of data in memory. Standard data types. Arithmetic and logical expressions. Conditional, cyclic, selective instructions. Debugging, testing and optimization of programs in C and C++. Data, character strings, the #define directive. Operations. Operators. The C language preprocessor. Arrays and pointers. Character strings and functions above them. Structures. Features of C++ in system programming. API functions. WMI. Containers and iterators in the STL library (Standard Template Library). Designer. The destructor. Polymorphism. Function overload. Virtual functions and abstract base classes. Multiple inheritance. User interaction with programs. Levels of abstraction in the software development process: architecture, structure, implementation</p> <p>Expected result: 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.</p> <p>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 the skills of: 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</p>
13	Programming in a high-level language	6	Database administration in the MS SQL platform, Database programming	<p>Fundamentals of computer modeling</p> <p>Purpose: formation of students' basic knowledge about the syntax of programming languages: Python 3, Ruby, Perl, Go and their capabilities; formation of a culture of creating readable code; formation of the ability to decompose a software project into functions, objects and modules; formation of the skill of designing and developing software using a version control system, including in the working environment the group.</p> <p>Contents: Solving problems on a computer. Introduction to the discipline. Stages of solving problems on a computer. Fundamentals of algorithmization. Basics of programming. A high-level programming language. The main elements of the language. Integrated programming environment. Language operators. Procedures and functions. Structured data types. Arrays, strings, sets. Working with files. Modular programming. Programming recursive algorithms. Creating and initializing an object. Encapsulation of responsibility in a class. The principle of the sole responsibility of the class. Relationships between classes. Inheritance and composition. Association. UML class diagram.</p> <p>Expected result:</p>

					<p>To know: the basic syntax of programming languages: Python 3, Ruby, Perl, Go and their capabilities; principles of forming readable code; methods of developing programs "top-down" and "bottom-up"; ideology of modular and object-oriented approach; typical solutions used to create programs;</p> <p>Be able to: develop readable programs; use both built-in and online library documentation; connect additional modules and standard modules and packages; apply an object-oriented approach to writing programs; develop programs both individually and in a team, using modern tools for writing and debugging programs.</p> <p>Possess: using integrated development environments (IDE) for writing programs; using an interactive console for interpreted programming languages; basic commands of the git version control system; debugging and introspection of someone else's program code.</p>
14	Modeling of information systems	5	Information systems software, Programming languages	Pre-graduate practice	<p>Purpose: discipline is to get acquainted with the basic principles of modeling, as well as the construction of static and dynamic models using modern software tools.</p> <p>Contents: Classification of models. Business modeling. Mathematical modeling. Basic concepts of simulation modeling. Queuing systems. Network modeling methods. Simulation modeling tools. Complex systems. Expected result:</p> <p>To know: the principles of building analytical and simulation models of information processes, the main classes of models and modeling methods, methods of formalization, algorithmization and implementation of models on a computer.</p> <p>Be able to: reasonably choose a modeling method; build an adequate model of a system or process using modern computer tools; interpret and analyze modeling results.</p> <p>possess: methods and techniques of working in CASE-tools; methods and techniques of modeling information systems on modern computers based on an analytical and simulation approach; the main criteria for evaluating the simulation results.</p>
14	Fundamentals of computer modeling	5	Programming of information systems, Programming in a high-level language	Pre-graduate practice	<p>Purpose: To master the theory, methods and technology of computer modeling in the study, design and application of information systems.</p> <p>Contents: Analytical and simulation apparatus of computer modeling. The Monte Carlo method. Simulation of random events. Modeling of continuous random variables. Modeling of discrete random variables. Modeling of multidimensional random variables. Modeling of event flows. Technology of building computer modeling systems. Organization of computer modeling. Computer modeling of economic and organizational systems.</p> <p>Expected result:</p> <p>To know: standard classes of models and methods of modeling complex systems, the apparatus of the Monte Carlo method, principles of constructing models of the processes of functioning of complex systems, methods of formalization and</p>

					<p>algorithmization; Be able to: use a systematic approach in the research, design and operation of information systems, develop modeling algorithms and implement them using algorithmic languages and modeling application software packages, automate the design process using modeling databases.</p> <p>Possess: the skills of using computer modeling tools to create psychological comfort of the user.</p>
15	Management in healthcare	5	Healthcare informatization, Computer-aided design and production systems,	Preparation for the thesis	<p>Purpose: To improve the quality and increase the number of medical services, and ultimately public health with the rational and efficient use of available resources.</p> <p>Content: The concept of management, organizations, types of organizations. Motivation, the main aspects of motivation. Analysis of the external and internal environment. Basic principles and objectives of health planning. Power and leadership, their difference. Management style, types. Classification of management decisions. Methods of managerial decision-making.</p> <p>Expected result:</p> <p>To know: sound theories of management in healthcare; about the main stages of development of management as a science and art; about the functions, organizational structures of management in healthcare; about the basic and methods of planning and system of public health protection; about the essence, content, typology, methods of managerial decision-making and its acceptance algorithm; about methods and principles of personnel management in medical organizations; about organizational, economic and financial aspects of health care management; about the principles of quality management in health care.</p> <p>Be able to: determine the goals and form the tasks of the organization's activities, the collective health system; conduct an assessment of the external and internal environment of the medical organization; apply management methods in the practical activities of the health manager; use information about the health of the population and the activities of the organization to offer measures to improve the quality and effectiveness of medical and preventive care; apply information technologies in the management activities of the health care manager; form work plans of the organization of the team; apply effective communication in the management system in to use external and internal motivation in the management of human resources in medical organizations.</p> <p>Possess: fundamentals of planning in the healthcare system; fundamentals of organization and management in the healthcare system; fundamentals of coordination of activities in the healthcare system; fundamentals of monitoring and evaluation of results in the healthcare system; designing organizational structures in healthcare</p>
15	Management in healthcare	5	Health information resources, Production automation	Preparation for the thesis	<p>Purpose: To acquaint students with modern approaches to the basics of management in the field of healthcare, to study, systematize and consolidate the basics of theory and practice of management in modern market conditions of management, to show</p>

					<p>the features of management of healthcare organizations at the present stage of development of healthcare in the Republic of Kazakhstan.</p> <p>Content: Health policy. Fundamentals of management: concept, principles, functions. Risk management in the healthcare system. Fundamentals of marketing: concept, principles, functions. Fundamentals of HR management. Comprehensive motivation of personnel of healthcare organizations. Economics and health. Quality management system. Features of the organization and quality control of medical services. New approaches to the remuneration of medical staff. Modern principles of organization of hospital care. "Hospital of the Future". Issues of forming a healthy lifestyle. Civil defense and organization of medical care in emergency situations.</p> <p>Expected result:</p> <p>To know: Marketing in the field of healthcare, basic principles of healthcare management, methods of healthcare management, basic functions of healthcare management, general concepts of economic management methods in healthcare, features of economic relations in the healthcare system: current state of the problem, the main provisions of the regulated market model in healthcare, methods of payment for outpatient care, methods of payment for inpatient assistance, types of economic analysis in healthcare.</p> <p>Be able to: determine the goals and form the tasks of the organization's activities, the collective health system; evaluate the external and internal environment of the medical organization; apply management methods in the practical activities of the health manager; use information about the health of the population and the activities of the organization to offer measures to improve the quality and effectiveness of medical and preventive care; apply information technologies in the management activities of the health manager; form work plans of the organization of the team; apply effective communication in the management system in healthcare; to use external and internal motivation in the management of human resources in medical organizations.</p> <p>Possess: fundamentals of planning in the healthcare system; fundamentals of organization and management in the healthcare system; fundamentals of coordination of activities in the healthcare system; fundamentals of monitoring and evaluating results in the healthcare system; designing organizational structures in healthcare.</p>
16	Web technologies	5	Information systems software	Preparation for the thesis	<p>Purpose: To teach students the principles of building and managing information systems that function with information and computing resources, remote and distributed based on the use of the Internet and Internet technologies.</p> <p>Content: Composition and general structure of information systems. Information system as a system for collecting, processing, transmitting and storing information. Basic concepts related to information. General definition of information:</p>

					<p>forms of information presentation; information and knowledge. Key components of information systems. Technology of working with information. Transmission of information in the system: source, receiver of information; information channel and information environment; basic information processes; collection, storage, transmission, receipt; search, processing of information. Structures, storage facilities and access methods. Modern trends in the development of information systems.</p> <p>Expected result:</p> <p>To know: the basics of the functioning of the World Wide Web; stages of website development; HTML hypertext markup language; technology for separating content and formatting using cascading CSS style sheets; modern technologies for developing websites; the procedure for using server technologies; principles of SEO optimization of websites.</p> <p>Be able to: create static HTML pages and apply style sheets; use tools for creating static sites (Web editor, graphic editor, etc.) to create interactive elements of Web pages; develop dynamic Web sites using modern site design technologies.</p> <p>Possess: hypertext markup language for building HTML documents;</p>
16	Programming on the Internet	3	Programming of information systems	Preparation for the thesis	<p>Purpose: To study modern methods of programming applications using the Internet environment in their work, as well as creating Internet sites filled with relevant and dynamically changing content.</p> <p>Contents: Introduction to Internet programming. Learning the markup language of hypertext HTML documents. Learning the CSS styling language. Programming in JavaScript. Creating client handlers. Creating server developers. The PHP programming language. Using databases in Internet applications. Designing Internet applications for business.</p> <p>Expected result:</p> <p>To know: the technology of creating Web pages using PHP; methods of building modern Internet resources, standards in the field of developing Internet resources, formats for storing graphic information for Internet resources, principles of building client and server components.</p> <p>Be able to: develop Web sites of varying complexity using PHP; develop Internet applications using modern development tools</p> <p>Possess: Web resource development skills using PHP.</p>
PROFILE DISCIPLINES					
Components of choice (KV)					
1	Medbiophysics	5	Physics 1	Medical electronics, Information and communication technologies in medicine	<p>Purpose: to form students' holistic understanding of the theoretical foundations and basic methods of molecular biophysics, the biophysics of membrane processes, the structure and functioning of biological membranes, the basic methods of studying membrane processes, the theoretical foundations and basic methods of studying photobiological processes, the theoretical foundations and basic methods of radiation</p>

					<p>biophysics, the basic biophysical methods of recording indicators of functional activity, application of the acquired knowledge and skills in solving professional tasks.</p> <p>Contents: Medical physics is an area of applied physics in which devices, equipment and physical factors of human impact used in medicine are studied.</p> <p>Expected result:</p> <p>To know: Modern methods of studying the structure and functions of biological membranes. Investigation of surface tension forces. Ionizing radiation. Dosimetry. Principles of conversion of biological and non-electrical signals into electrical structures of sensors and electrodes, their main characteristics. The device, the principle of operation of the electrocardiograph. The main approaches to ECG registration. ECG registration and principles of analysis. The device, the principle of operation of the electroencephalograph. The main rhythms of the EEG. EEG registration and principles of analysis. Laser radiation. The device, the principle of operation of spectrophotometers. Application of spectrophotometric research methods to determine the concentration of substances in biological fluids. Polarization of light by biosystems. Special techniques of microscopy of biological objects.</p> <p>Be able to: use physical methods of diagnosis and treatment of patients with the help of sophisticated technical equipment, including for the safe use of ionizing radiation sources; prepare appropriate equipment that conducts medical irradiation of patients as prescribed by a doctor.</p> <p>Own: the ability to conduct fundamental and applied research in the field of the effect of physical factors on the human body, ensuring the radiation safety of personnel and ensuring the quality of irradiation of patients when using ionizing radiation sources in medicine; all kinds of physical phenomena, processes and structures observed in nature; conducting physical research; using the results of scientific research in innovation; processing and analyze the data obtained with the help of modern information technologies; operate modern physical equipment and equipment; participate in the information and technical organization of scientific seminars and conferences; understand and apply in practice management methods in the field of environmental management; write and design scientific articles and reports with excursion, educational and circle work</p>
1	Medical Physics and Medical Imaging	5	Physics 1	Fundamentals of designing devices and systems for medical purposes, Medical Informatics	<p>Purpose: Imaging physics in medicine is an introduction to the physical foundations of imaging for the purposes of medical diagnostics and research in biology.</p> <p>Content: Medical physics is a field of applied physics that studies instruments, equipment and physical factors of influence on a person used in medicine. Magnetic resonance imaging. EPR tomography. Obtaining images using IR radiation. Acoustics. Ultrasound. Ultrasound imaging. Mathematical foundations of the processes of</p>

					<p>formation and processing of images. Image analysis in medicine. Image visualization for diagnosis and therapy.</p> <p>Expected Result:</p> <p>Know: the basics of the interaction of various radiations with biological tissues, the physical foundations of various types of imaging in medicine; methods for studying blood circulation; integral and regional rheography; methods of indirect registration of shock and minute ejection; physical foundations of hemodynamics; nuclear magnetic resonance. Physics of ultrasound. Physico-technical foundations of radiology. The device and principles of operation of X-ray equipment (X-ray, CT); Ultrasound devices; MRI devices. Apparatus for scintigraphy and radionuclide diagnostics. Organization of the work of the X-ray department, photo laboratory.</p> <p>Be able to: use physical methods for diagnosing and treating patients with the help of sophisticated technical equipment, incl. for the safe use of sources of ionizing radiation; prepare appropriate equipment for medical exposure of patients as directed by a doctor.</p> <p>Possess: the ability to conduct fundamental and applied research in the field of the effect of physical factors on the human body, ensuring the radiation safety of personnel and ensuring the quality of patient exposure when using sources of ionizing radiation in medicine; all kinds of physical phenomena, processes and structures observed in nature; conducting physical research; method application of the results of scientific research in innovative activities; process and analyze the received data using modern information technologies; operate modern physical apparatus and equipment; participate in the information and technical organization of scientific seminars and conferences; understand and apply in practice management methods in the field of nature management; excursion, educational and circle work; write and design scientific articles and reports</p>
2	Informatization of healthcare	5	Public health and healthcare	healthcare management	<p>Purpose: Ensuring the functioning of the industry by informatization of the activities of medical institutions at all levels to improve the quality of medical and preventive care and the effectiveness of healthcare management.</p> <p>Contents: Basic provisions of healthcare informatization. Objects and subjects of informatization in the field of healthcare. Prospects of Kazakhstan in building a modern healthcare informatization system. E-health development trend in the Republic of Kazakhstan.</p> <p>Expected Result:</p> <p>Know: the use of information computer systems in medicine and healthcare; theoretical foundations of informatics, collection, storage, search, processing, transformation, dissemination of information in health care; state standards on electronic medical history, as well as methods and means of protecting personal data in medical information systems; principles of automating the management of healthcare institutions using modern information technologies; algorithms and software tools for decision support during the treatment and diagnostic process. theoretical foundations of</p>

					<p>informatics, collection, storage, search, processing, modification, dissemination of information in medical and biological systems, use of information computer systems in medicine and healthcare; methods, software and hardware of medical statistics used at various stages of obtaining and analyzing biomedical information.</p> <p>Be able to: work with e-health with a mobile application; carry out textual and graphical processing of medical data using standard operating system tools and common office applications, as well as applied and special software tools; use statistical and heuristic algorithms, methods for obtaining knowledge from data, expert systems for diagnosing and managing the treatment of diseases.</p> <p>Own: terminology associated with modern information and telecommunication technologies in relation to solving the problems of medicine and health care; basic information transformation technologies using database management systems in healthcare; basic skills in the use of medical information systems and Internet resources for the implementation of professional tasks.</p>
2	Health Information Resources	5	social medicine	Management in healthcare	<p>Purpose: Mastering the theoretical foundations of medical informatics and the practice of applying modern information and telecommunication technologies in medicine and healthcare.</p> <p>Contents: Information resources of public health. Information resources of medical and economic activities of healthcare organizations. Current state and trends of information technologies in health care.</p> <p>Expected Result:</p> <p>Know: state standards on electronic medical records, as well as methods and means of protecting personal data in medical information systems; principles of automating the management of healthcare institutions using modern information technologies; algorithms and software tools for decision support during the treatment and diagnostic process. theoretical foundations of informatics, collection, storage, search, processing, modification, dissemination of information in medical and biological systems, use of information computer systems in medicine and healthcare; methods, software and hardware of medical statistics used at various stages of obtaining and analyzing biomedical information.</p> <p>Be able to: carry out textual and graphical processing of medical data using standard operating system tools and common office applications, as well as applied and special software tools; use statistical and heuristic algorithms, methods for obtaining knowledge from data, expert systems for diagnosing and managing the treatment of diseases.</p> <p>Own: basic technologies of information transformation using database management systems in healthcare; basic skills in the use of medical information systems and Internet resources for the implementation of professional tasks.</p>
3	Health Information Resources	5	social medicine	Management in healthcare	<p>Purpose: Mastering the theoretical foundations of medical informatics and the practice of applying modern information and telecommunication technologies in medicine and healthcare.</p> <p>Contents: Information resources of public health. Information resources of medical and economic activities of healthcare organizations. Current state and trends of information technologies in health care.</p> <p>Expected Result:</p> <p>Know: state standards on electronic medical records, as well as methods and means of protecting personal data in medical information systems;</p>

					<p>principles of automating the management of healthcare institutions using modern information technologies; algorithms and software tools for decision support during the treatment and diagnostic process. theoretical foundations of informatics, collection, storage, search, processing, modification, dissemination of information in medical and biological systems, use of information computer systems in medicine and healthcare; methods, software and hardware of medical statistics used at various stages of obtaining and analyzing biomedical information.</p> <p>Be able to: carry out textual and graphical processing of medical data using standard operating system tools and common office applications, as well as applied and special software tools; use statistical and heuristic algorithms, methods for obtaining knowledge from data, expert systems for diagnosing and managing the treatment of diseases.</p> <p>Own: basic technologies of information transformation using database management systems in healthcare; basic skills in the use of medical information systems and Internet resources for the implementation of professional tasks.</p>
3	Modern medical information systems and telemedicine	5	Computer-aided design systems in medicine	Information Systems Administration, Field Practice II	<p>Purpose: To form students' knowledge about the essence and significance of informatization of health care in general, modern information technologies for ensuring the treatment and diagnostic process, management in health care and biomedical research.</p> <p>Contents: "Modern medical information systems. Telemedicine in the professional activity of a doctor. Information systems in medicine. New opportunities and prospects for the use of information technologies in healthcare. Telemedicine in the professional activity of a doctor. Trends in the development of computer technologies in medicine. Telemedicine systems. Information systems in medicine. Ensuring information security in telemedicine. Telemedicine in the professional activity of a doctor.</p> <p>Expected results:</p> <p>Know: the essence and main provisions of the use of modern information technologies and video conferencing in medicine, medical science and healthcare; theoretical foundations for obtaining, collecting, entering, storing, searching, processing, transforming, distributing and protecting medical information, types and classification of modern medical information systems; telemedicine consultations for patients; remote biomonitoring.</p> <p>Be able to: use various types of modern medical information and telemedicine systems for professional activities; provide highly qualified and timely medical care to remote patients; to use and apply telecommunications in order to connect specialists with hospitals, clinics, and other doctors.</p> <p>Own: basic technologies and equipment for converting audio-video and other types of biomedical information using graphic, text, spreadsheet editors and applications, searching for it on the Internet; system using videoconferencing in healthcare.</p>

4	Expert systems in medicine	5	Fundamentals of Artificial Intelligence Robotics	Data science and neural networks in medicine	<p>Purpose: To create a single information space; Monitor and manage the quality of medical care; To increase the transparency of the activities of medical institutions, as well as the effectiveness of management decisions; To study the economic aspects of the provision of medical care; Reduce the time of examination and treatment of patients.</p> <p>Contents: Expert systems in the diagnosis of diseases. Expert systems for monitoring the patient's health status. Expert systems for treatment planning. Expert systems for predicting the development of diseases. Expert systems for recognition of images and signals.</p> <p>Expected Result:</p> <p>Know: application of expert systems in medicine; medical diagnostic system; predictive system; planning system; interpreting system.</p> <p>To be able to: solve problems of diagnostics, differential diagnostics, forecasting, choice of strategy and tactics of treatment; define an expert system (ES) as a software system that uses expert knowledge to provide highly efficient problem solving in medicine; use various expert systems in medicine; solve problems that require expert knowledge for their solution; use diagnostic systems to establish a connection between disturbances in the body's activity and their possible causes.</p> <p>Possess: expert knowledge for solving medical problems; the main methods for the use of medical information systems in the treatment and diagnostic process.</p>
4	Information and computing expert systems in medicine	5	Robotic systems and complexes	big data	<ul style="list-style-type: none"> - Purpose: To provide systematic assistance to medical personnel in the event of controversial and problematic situations in the treatment of patients. - Contents: The concept of an information system (IS). An overview of the applications of the systems approach in medical informatics, clinical practice, biomedical research and health care management. Algorithmization of decision-making procedures in medicine. Structure of expert systems. Subjects of expert systems. Stages of development of expert systems. Medical expert system MYCIN. STRIPS scheduler. - Know: definition of an information system, tasks of medical information and computing systems, classification, 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. - Be able to: draw up and analyze the block diagram of the software complex of the automated hospital information system of the medical institution; enter information about treated patients in AS Hospital; to form a consolidated and personalized register account for mutual settlements with an insurance medical organization in AS Hospital; - Own: modern computer tools for creating expert systems in the clinic of internal diseases, modern software tools for processing experimental and clinical diagnostic data, skills in introducing new medical technologies and software and hardware systems for studying diseases of internal organs, methods of computational diagnostics and predicting the patient's condition.
4	Information and	5	Robotic	big data	<p>Purpose: To provide systematic assistance to</p>

	computing expert systems in medicine		systems and complexes		<p>medical personnel in the event of controversial and problematic situations in the treatment of patients.</p> <p>Contents: The concept of an information system (IS). An overview of the applications of the systems approach in medical informatics, clinical practice, biomedical research and health care management. Algorithmization of decision-making procedures in medicine. Structure of expert systems. Subjects of expert systems. Stages of development of expert systems. Medical expert system MYCIN. STRIPS scheduler.</p> <p>Expected result:</p> <p>Know: definition of an information system, tasks of medical information and computing systems, classification, 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.</p> <p>Be able to: draw up and analyze the block diagram of the software complex of the automated hospital information system of the medical institution; enter information about treated patients in AS Hospital; to form a consolidated and personalized register account for mutual settlements with an insurance medical organization in AS Hospital;</p> <p>Own: modern computer tools for creating expert systems in the clinic of internal diseases, modern software tools for processing experimental and clinical diagnostic data, skills in introducing new medical technologies and software and hardware systems for studying diseases of internal organs, methods of computational diagnostics and predicting the patient's condition.</p>
5	Mathematical methods of evidence-based medicine	4	Mathematics II, Biostatistics	Methods of processing medical information	<p>Purpose: formation of students' systemic knowledge about the mathematical foundations of evidence-based medicine. Familiarization of students with the basics of the modern mathematical apparatus as a means of solving theoretical and practical problems of physics, chemistry, biology, studying the physical laws underlying basis of life processes and their application to solving medical problems, providing future doctors with the necessary information on the statistical processing of biomedical information.</p> <p>Contents: Fundamentals of the theory of probability. Statistical aggregates. Statistical criteria. Correlation and regression. Temporal analysis. Hierarchy. Pyramid of arguments.</p> <p>Expected Result:</p> <p>Know: the definition of an information system, the 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, and development stages.</p> <p>Be able to: development and analysis of the block diagram of the software complex of an automated hospital information system of a medical institution; inclusion of information on hospitalized patients; formation of consolidated and personalized accounts for mutual settlements with the AS medical organization in the hospital;</p> <p>Own: modern computer tools for creating an examination system in an internal medicine clinic, modern software for processing experimental and clinical diagnostic data, with the introduction of new medical technologies and</p>

					software and hardware systems for studying diseases of internal organs, computational diagnostics and methods for predicting the patient's condition.
6	Mathematical processing of experimental data	4	Mathematics II, Statistical Analysis in Healthcare	Medical Data Processing Software	<p>Purpose: is the development by students of a set of means and methods of activity aimed at the use of mathematical methods of data processing, taking into account errors.</p> <p>Contents: Distribution laws: uniform, normal (Gaussian), Student's. "chi-square", exponential, Fisher. Confidence interval and confidence probability. Correlation analysis. Regression analysis. Construction and evaluation of linear regression equations. Least squares method (LSM). Nonlinear regression models. The significance of the coefficients according to Student's criterion. Dispersion analysis.</p> <p>Expected Result:</p> <p>Know: the basics of mathematics, physics, computing and programming; basic software development methodologies, relational database design theory, basic software life cycle models, software testing methods, basic approaches to the software development process.</p> <p>Be able to: solve standard professional problems using natural science and general engineering knowledge, methods of mathematical analysis and modeling; choose a software development methodology depending on the task, design relational databases, choose the most appropriate software life cycle model, test the developed software.</p> <p>Possess: the skills of theoretical and experimental research of objects of professional activity; skills relational database design, software testing methods and techniques, team software development skills, skills in using various technologies and software development tools.</p>
6	Graphic images in medicine and healthcare	4	Medical Informatics	Medical Data Processing Software	<p>Purpose: Mastering the basic concepts and methods of computer graphics; study of popular graphics programs and publishing systems; acquisition of skills in preparing images for publication, including in electronic form; mastering the basics of computer design; acquaintance with various areas of application of methods and means of computer graphics in modern society.</p> <p>Contents: Types of graphic images. Requirements for the construction of graphic images. Application of line diagrams and methods of their construction. Graphic images reflecting the seasonality of the phenomenon. Plane diagrams and methods of their construction.</p> <p>Expected Result:</p> <p>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.</p> <p>Be able to: create and process computer graphics in the best way; work with basic two-dimensional and three-dimensional graphic editors; to design the design of web pages in accordance with the terms of reference, using site design technologies.</p> <p>Own: basic techniques for creating and editing images in vector editors; skills in editing photorealistic images in raster editors.</p>
7	Information systems administration	4	Database administration in MS SQL Server platform, Information security audit, Modern medical information systems and telemedicine	Preparation of the thesis	<p>Purpose: formation of students' information culture of future specialists, adequate to the current level and development prospects in the field of information systems administration, as well as the development of knowledge on information, organizational and software administration services, operation and maintenance of information systems of various directions for managing all levels of the subject area.</p> <p>Contents: Fundamentals of administration of networks and network information systems. Network</p>

					<p>administration. web administration. Planning and managing Active Directory. Means of ensuring the security of information systems.</p> <p>Expected Result:</p> <p>Know: basic information about the formation and functioning of management services; issues of ensuring information security and functioning of information systems of administration; functions and responsibilities of making managerial decisions of the network administrator in matters of preventing and neutralizing threats to the functioning of information systems.</p> <p>Be able to: use programming languages and systems to automate information processes to collect information necessary for processing and making managerial decisions; work with general purpose software, search for information using search rules (query building) in databases, computer networks of reference information; apply software tools and mathematical models in the decision-making process, setting and formalizing the tasks of expert decision support, analyzing and interpreting the results obtained.</p> <p>Possess: knowledge of information management systems and methods of information processes and technologies for making management decisions for the functioning of information management systems in accordance with the requirements for software at various levels of administrative management. skills in the practical use of modern software and computers and peripherals.</p>
7	Automated information processing and control systems	4	Database administration in the MS SQL Server platform, Information privacy protection, Information systems of medical technological processes	Preparation of the thesis	<p>Purpose: Development of scientific foundations for building automated information processing and control systems. Development of theoretical foundations for algorithmization of functional tasks of management and information processing, efficiency analysis</p> <p>Contents: Automated information systems: basic concepts and terminology, classification. Functioning of automated information systems. Automated control systems.</p> <p>Expected Result:</p> <p>Know: the regulatory framework for the development and execution of technical documentation; methods of designing automated information systems; typical components of automated information systems; features of operation of computer networks of various types; principles of building distributed information systems; composition software for automated information systems; methods of ensuring information security; methodology for improving technological solutions; basic methods of quality management of products and services; methodology for assessing the quality and reliability of products;</p> <p>- procedure for certification of manufactured products and services; general principles of personnel management.</p> <p>Be able to: develop technological processes for automated information processing, develop, modify, adapt and maintain components of automated information systems; to install, adapt, maintain and operate the software of automated information systems; to carry out the optimal choice of information, software and hardware in the formation and modification of automated information systems; to operate automated information systems; ensure compatibility of hardware and software protection of computer</p>

					<p>technology; develop instructional documentation for the maintenance of automated information systems;</p> <p>Own: methodology for analyzing the subject area and designing applied ASOIU; the ability and skills of choosing and verifying different protocols; levels of architecture of the digital network of integrated services, methods for evaluating the effectiveness of specific variants of integrated networks; methods of system analysis of ASOIU interfaces.</p>
8	Methods of processing medical information	4	Mathematical methods of evidence-based medicine, 3D modeling in medicine	Industrial practice III, Preparation of the thesis	<p>Purpose: To promote the implementation of the main function of protecting public health - increasing the duration of active life by creating new information technologies that improve the quality of the treatment and diagnostic process.</p> <p>Contents: Fundamentals of information theory and coding. Generalized transformations in problems of filtering and compression of biomedical data. The main tasks of medicine, pharmacy and health care in the refraction of the use of automated information systems (AIS). Assessment of technology needs and expected benefits. Tasks of AIS in health care. Components of "AIS hospital". Components of "AIS Polyclinic". Interpretation of the results of AIS application. Stages of creating AIS LPO.</p> <p>Expected Result:</p> <p>Know: analysis of the latest achievements in the field of automation of medical information processing; structural analysis of medical automated information system; a workflow automation system for medical institutions, which combines a medical decision support system, electronic medical records about patients, digital medical research data, patient monitoring data from medical devices, communication tools between employees, financial and administrative information</p> <p>Be able to: work with medical automated information system; develop, modify, adapt and maintain components of automated information systems in medicine; develop instructional documentation for the maintenance of automated information systems in medicine;</p> <p>Own: the main functions of automation of information systems in medicine; principles of building information systems in medicine.</p>
8	Medical Data Processing Software	4	Mathematical processing of experimental data, Graphic images in medicine and healthcare	Industrial practice III, Preparation of the thesis	<p>Purpose: improving the quality of training students in the treatment of critical and terminal conditions through the use of modern technologies for mastering and improving practical skills.</p> <p>Contents: The role of automated information systems in medical organizations, scientific research, educational process, pharmaceutical organizations. Problems of informatization in health care. A high-tech emergency manikin for teamwork using real life-saving equipment. Simulator for endo video surgical interventions – Lapsim. Computer interactive mannequin of the woman in labor Noelle. Multifunctional interactive simulator for obstetric care.</p> <p>Expected Result:</p> <p>To know: mastering manual, medical-tactical and</p>

					<p>communication skills by introducing high-tech robotic dummies and dummies, virtual simulators into the educational process of a medical university in order to improve the quality of practical training of a future doctor.</p> <p>Be able to: assess the severity of the patient's condition, determine the volume and sequence of necessary measures to provide assistance, organize emergency care in emergency cases</p> <p>Possess: manipulation skills for patient care (treatment of the oral cavity, washing, feeding, bedding, dressing, moving, assistance with natural needs)</p>
8	Medical Data Processing Software	4	Mathematical processing of experimental data, Graphic images in medicine and healthcare	Industrial practice III, Preparation of the thesis	<p>Purpose: improving the quality of training students in the treatment of critical and terminal conditions through the use of modern technologies for mastering and improving practical skills.</p> <p>Contents: The role of automated information systems in medical organizations, scientific research, educational process, pharmaceutical organizations. Problems of informatization in health care. A high-tech emergency manikin for teamwork using real life-saving equipment. Simulator for endo video surgical interventions – Lapsim. Computer interactive mannequin of the woman in labor Noelle. Multifunctional interactive simulator for obstetric care.</p> <p>Expected Result:</p> <p>To know: mastering manual, medical-tactical and communication skills by introducing high-tech robotic dummies and dummies, virtual simulators into the educational process of a medical university in order to improve the quality of practical training of a future doctor.</p> <p>Be able to: assess the severity of the patient's condition, determine the volume and sequence of necessary measures to provide assistance, organize emergency care in emergency cases</p> <p>Possess: manipulation skills for patient care (treatment of the oral cavity, washing, feeding, bedding, dressing, moving, assistance with natural needs)</p>

LIST OF DISCIPLINES
components of choice for the educational program
6B06123 IT IN HEALTH

Duration of study: **4 years**
 Form of study: **full-time**

Year of admission: **2022**

№	Name of the discipline	Discipline code	Number of credits	semester
2. Basic disciplines				
1	Component of choice 1			
	Databases in IP	DBIP 2210	5	3
	Database concept	DC 2210		
2	Component of choice 2			
	Operating systems	OS 2211	5	3
	PC operating systems and Software	PCOSS 2211		
3	Component of choice 3			
	Fundamentals of robotics and artificial intelligence	FRAI 2212	6	4
	Robotic systems and complexes	RSC 2212		
4	Component of choice 4			
	Public health and healthcare	PHH 2213	6	4
	Social Medicine	SM 2213		
5	Component of choice 5			
	Information and communication technologies in medicine	ICTM 2214	6	4
	Medical Informatics	MI 2214		
6	Component of choice 6			
	Computer-aided design systems in medicine	CADSM 3215	5	5
	Automation of production	AP 3215		
7	Component of choice 7			
	Programming technologies	TP 3216	5	5
	Database programming	PBD 3216		
8	Component of choice 8			
	Medical Electronics	ME 3217	5	5
	Fundamentals of designing medical devices and systems	FDMDS 3217		
9	Component of choice 9			
	Medical statistics	MS 3218	5	5
	Health system statistics	HSS 3218		
10	Component of choice 10			
	Information systems software	ISS 3219	5	6
	Programming of information systems	PIS 3219		
11	Component of choice 11			
	Biostatistics	Bio 3220	5	6
	Statistical analysis in healthcare	SAH 3220		
12	Component of choice 12			
	Audit information security	AIS 3221	5	6
	Protecting the privacy of information	PPI 3221		
13	Component of choice 13			
	Programming languages	PL 3222	6	6
	Programming in a high-level language	PHLL 3222		
14	Component of choice 14			
	Modeling of information systems	MIS 4223	5	7
	Fundamentals of computer modeling	FKM 4223		
15	Component of choice 15			
	Management in healthcare	MH 4224	5	7
	Management in healthcare	MH 4224		
16	Component of choice 16			
	Web technologies	WT4225	3	7

	Programming on the Internet	PI4225		
3. Profile disciplines				
1	Component of choice 1			
	Medbiophysics	Med 2305	5	3
	Medical physics and medical visualization.	MFMV 2305		
2	Component of choice 2			
	Informatization of healthcare	IH 3306	5	5
	Health information resources	HIR 3306		
3	Component of choice 3			
	Modern medical information systems and telemedicine	MMIST 3307	5	6
	Information systems of medical technological processes	ISMTP 3307		
4	Component of choice 4			
	Expert systems in medicine	ESM 4308	5	7
	Information and computing expert systems in medicine	ICESM 4308		
5	Component of choice 5			
	Mathematical methods of evidence-based medicine	MMDM 4309	4	7
	Mathematical processing of experimental data	MPED 4309		
6	Component of choice 6			
	3D modeling in medicine	3DMM 4310	4	7
	Graphic images in medicine and healthcare	GIMH 4310		
7	Component of choice 7			
	Administration of information systems	AIS 4311	4	7
	Automated information processing and management systems	ASPMS 4311		
8	Component of choice 8			
	Methods of processing medical information	MPMI 4312	4	8
	Medical data processing software	MDPS 4312		
9	Component of choice 9			
	Data science and neural networks in medicine	DSiNM 4313	5	8
	Big Data	BD 4313		