



**Institute of Automation and information technologies**  
**Department of Cybersecurity, information processing and storage**

**EDUCATIONAL PROGRAM**  
**6B06102 "Computer Science"**

Code and classification of the field of education: **6B06 "Information and communication technologies"**

Code and classification of training directions: **6B061 "Information and communication technologies"**

Group of educational programs: **B057 "Information technologies"**

Level based on NQF: **6**

Level based on IQF: **6**

Study period: **4 years**

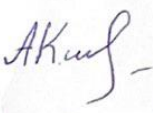






Amount of credits: **240**

**Almaty 2023**

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Was reviewed and recommended for approval at the meeting of K.I.Satbayev KazNRTU Educational and Methodological Council Minutes # 3 dated "17" November 2022.

Educational program 6B06102 "Computer Science" was developed by Academic committee based on direction 6B061 "Information and communication technologies".

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## **List of abbreviations and designations**

EP – educational program

BC – basic competencies

PC – professional competencies

LO – learning outcomes

MOOC – massive open online courses

NQF – National Qualifications Framework

IQF – Industry Qualifications Framework

IT – information Technology

## **1. Description of educational program**

The educational program 6B06102 "Computer Science" is aimed at teaching students general education, basic and specialized disciplines with the achievement of relevant competencies:

- to provide practice-oriented training of graduates in the field of software development, information systems and specialists in the field of data analysis. Training of graduates who are able to apply various technologies, knowledge and skills of software development, definition and management of information systems, data analysis to perform operational and project activities;

- to prepare graduates for production and technological activities related to the process of developing and modifying software products aimed at meeting the expectations and requirements of users, for organizational and managerial activities related to the maintenance of software products of various classes and categories, information systems management, data analysis;

- create conditions for continuous professional self-improvement, development of social and personal competencies of graduates (broad cultural outlook, active citizenship, commitment, organization, diligence, sociability, ability to argue and make organizational and managerial decisions, knowledge of modern information technologies, fluency in several languages, striving for self-development and commitment to ethical values and a healthy lifestyle life, the ability to work in a team, responsibility for the final result of their professional activities, civic responsibility, tolerance), social mobility and competitiveness in the labor market.

The EP is based on the state educational standard for higher professional education; on the professional standard; Atlas of New Professions.

The content of the disciplines of the educational program has been developed taking into account the relevant educational programs of the world's leading universities, the international classifier of professional activity in the field of information and communication technologies.

Graduates of the educational program 6B06102 "Computer Science" are focused on the organization, design and development of software for applied purposes for all sectors of the economy, government organizations and other fields of activity.

The educational program ensures the application of an individual approach to students, the transformation of professional competencies from professional standards and qualification standards into learning outcomes. Student-centered learning is provided - the principle of education, which assumes a shift of emphasis in the educational process from teaching (as the main role of the teaching staff in the "translation" of knowledge) to teaching (as an active educational activity of the student).

The educational program provides training of specialists in the field of information security in 2 directions:

- Software engineering. Software developers of a wide range. The educational program provides knowledge of various programming paradigms and operating

systems, obtaining skills in designing and developing software products for any platform.

- Artificial intelligence. Data analysis specialists. The educational program provides knowledge of various models and methods of data analysis, including modern tools for extracting and processing large amounts of data, the use of artificial neural network models for classification and regression problems, methods and algorithms related to the field of artificial intelligence.

The educational program was developed based on the analysis of the labor functions of software development engineers, artificial intelligence and data science specialists.

Representatives of Kazakhstani companies and associations, specialists of departmental structures in the field of software development, artificial intelligence and data science participated in the development of the educational program.

In case of successful completion of the full bachelor's degree course, the graduate is awarded a bachelor's degree in information and communication technologies under the EP 6B06102 "Computer Science".

## **2. Purpose and objectives of educational program**

**Purpose of EP:** The goal of the educational program is to comprehensively prepare IT professionals in the field of computer science for work in industry, business and government, combined with a solid foundation in machine learning, data science and software development.

### **Tasks of EP:**

- socio-humanitarian and professional training of bachelors in the field of computer science in accordance with the development of science and production, as well as with the needs of the ICT clusters of Kazakhstan, the IT industry of the Republic of Kazakhstan, national research centers, master's and doctoral studies of higher educational institutions;

- integration of educational and scientific activities;

- establishing partnerships with leading universities of the near and far abroad in order to improve the quality of education;

- expansion of relations with customers of educational services, employers in order to determine the requirements for the quality of training of specialists, conducting courses, seminars, master classes, internships, industrial practices.

The content of the educational program 6B06102 "Computer Science" is implemented in accordance with the credit technology of training and is carried out in the state and Russian languages.

The educational program will make it possible to implement the principles of the Bologna process. Based on the choice and independent planning by students of the sequence of studying disciplines, they independently form an individual study plan (IUP) for each semester according to the Working Curriculum and the Catalog of elective disciplines. The volume of mathematical, natural science, basic and language disciplines has been increased in the educational program.

The following disciplines are studied: "Information and communication

technologies", "Algorithmization and programming basics", "Information security and information protection", "Algorithms and data structures", "Web application development", "Operating systems", "Computer graphics", "Computer vision", "Computer networks", "Blockchain technologies", "Databases", "Development of client-server applications", "Development of web services", "Analysis and processing of web data", "Methods of analysis and processing of big data", etc.

Students have internships in banking structures, government and departmental structures, in such companies as JSC "Kaspi Bank", JSC "Halyk Bank", LLP "Suretter Software", JSC "Centercredit Bank", etc.

According to the academic mobility program, the best students have the opportunity to study at leading foreign universities according to the corresponding EP.

### **3. Requirements for evaluating the educational program learning outcomes**

The educational program was developed in accordance with the State mandatory Standards of higher and Postgraduate Education, approved by the Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2 (registered in the Register of State Registration of Regulatory Legal Acts under No. 28916) and reflects the learning outcomes on the basis of which curricula are developed (working curricula, individual curricula of students) and working curricula in disciplines (syllabuses). Mastering disciplines of at least 10% of the total volume of credits of the educational program using MOOC on the official platform <https://polytechonline.kz/cabinet/login/index.php/>, as well as through the study of disciplines through the international educational platform Coursera <https://www.coursera.org/>.

Evaluation of learning outcomes is carried out according to the developed tasks within the educational program in accordance with the requirements of the state mandatory standard of higher and postgraduate education.

When evaluating learning outcomes, uniform conditions and equal opportunities are created for students to demonstrate their knowledge, skills and abilities.

When conducting an interim certification in an online form, online proctoring is used.

## **4. Passport of educational program**

### **4.1. General information**

<b>№</b>	<b>Field name</b>	<b>Comments</b>
1	Code and classification of the field of education	6B06 "Information and communication technologies"
2	Code and classification of training directions	6B061 "Information and communication technologies"
3	Educational program group	B057 "Information technologies"
4	Educational program name	6B06102 "Computer Science"

5	Short description of educational program	To provide practice-oriented training of graduates in the field of software development, information systems and specialists in the field of data analysis. Training of graduates who are able to apply various technologies, knowledge and skills of software development, identification and management of information systems, data analysis to perform operational and project activities.
6	Purpose of EP	The goal of the educational program is to comprehensively prepare IT professionals in the field of computer science for work in industry, business and government, combined with a solid foundation in machine learning, data science and software development.
7	Type of EP	New
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	Her
11	List of competencies of educational program	<p>Basic competencies: To program in modern algorithmic languages, to understand the fundamental principles of software construction; to master various approaches in programming methodology, to know the paradigms of modular and object-oriented programming.</p> <p>Organize, manage and ensure the processes of the full life cycle of testing; develop regulations, test schedules; Simulate test processes, test data, function responses to test impacts; analyze the compliance of software characteristics in technical and project documentation; generate testing documentation.</p> <p>Professional competencies: Be able to create and configure scalable applications using the object-oriented programming paradigm.</p> <p>Use design patterns.</p> <p>Plan and carry out work on the organization of data collection, analysis and interpretation processes.</p>
12	Learning outcomes of educational program	<p>ON1: Knows and understands the basics of physical and mathematical, natural sciences, social, humanitarian and economic disciplines used in solving standard problems of professional activity, and influencing the formation of a harmonious personality with a broad outlook and critical thinking.</p> <p>ON2: Demonstrate an understanding of the fundamentals of programming, software development, development of algorithms and data structures, object-oriented programming.</p> <p>ON3: Design and create software, web applications, mobile applications using the UML language, modern development tools, libraries, patterns and frameworks.</p> <p>ON4: Implement machine learning and artificial intelligence algorithms.</p> <p>ON5: Demonstrate basic knowledge of low-level programming, understanding of computer architecture, and software development for resource-constrained computing systems.</p>



		<p>ON6: Demonstrate an understanding of the basics of information security and ways to prevent various attacks on information systems.</p> <p>ON7: Demonstrate the ability to work in a team, communicate effectively with partners, organize the process of software development.</p> <p>ON8: Demonstrate the ability to configure and maintain information systems, including determining the topology of network interaction of computing resources.</p> <p>ON9: Demonstrate the ability to configure and maintain information systems, including determining the topology of network interaction of computing resources.</p> <p>ON10: Use cloud technologies and deploy software on servers.</p> <p>ON11: Analyzes and evaluates corruption studies using the theory and methods of the sociological study of corruption.</p> <p>ON12: Knows and understands trends in the development of computer graphics, its role and importance in IT products and objects, methods for constructing flat projection models of three-dimensional space.</p> <p>ON13: Selects typical methods and methods for performing professional tasks, evaluates their effectiveness and quality.</p> <p>ON14: Chooses methods and means of protection against dangers in everyday life and in professional activities; chooses ways to create and maintain safe living conditions.</p> <p>ON15: Compiles an infological model and a datalogical (conceptual) schema of databases, defines integrity constraints and data access rights.</p>
13	Education form	Full-time, online
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Bachelor's degree in information and communication technologies
18	Developer(s) and authors	Moldagulova A.N., Kasymova A.B.

### 4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)														
				ON1	ON2	ON3	ON4	ON5	ON6	ON7	ON8	ON9	ON10	ON11	ON12	ON13	ON14	ON15
<b>Cycle of general education disciplines</b>																		
<b>Required component</b>																		
1	Foreign language	English is a compulsory subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10	v														
2	Kazakh (russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to learn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10	v														
3	Physical culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within	8	v														

		the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.															
4	Information and Communication technology (MOOC)	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5	v					v								
5	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of	5	v													

		Kazakhstan in world history.																
6	Philosophy (MOOC)	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.	5	v														
7	Module of socio-political knowledge (sociology, political science) (MOOC)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of	3	v														

		one's responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.																
8	Module of socio-political knowledge (cultural studies, psychology) (MOOC)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5	v														
<b>Cycle of general education disciplines</b>																		
<b>Component of choice</b>																		
9	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corrupt behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various spheres. The purpose of studying the discipline	5	v											v			

		«Fundamentals of anti-corruption culture and law» is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in everyday practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.															
10	Fundamentals of scientific research methods	The main objectives of the academic discipline "Fundamentals of scientific research methods" is to form ideas about the methodological side of knowledge, using the concepts and principles of logic and dialectics, as well as to form students' knowledge and understanding of the methodology of scientific research; to teach how to draw up the structure of future scientific work; to teach the correct formulation of goals, setting goals; to teach the definition of the object and subject of research; to master the competent selection of scientific research methods.	5	v													
11	Fundamentals of	Discipline studies the foundations	5	v												v	

	economics and entrepreneurship	of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and development prospects; the theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; The readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, the stages of career, qualities, competencies and responsibility of the entrepreneur, theoretical and practical business planning and economic examination of business ideas, as well as the analysis of the risks of innovative development, the introduction of new technologies and technological solutions.															
12	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and	5	v													v

		ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies																
<b>Cycle of basic disciplines University component</b>																		
13	Algorithmization and programming basics	The course explores the fundamental concepts of programming: operator, variable, procedure, function, data type. The main structures of algorithms are considered, such as linear, branched, cyclic. The course examines the basic forms of data representation: strings, structures, arrays, lists. Separate topics are devoted to the creation of widely used sorting algorithms, searching for the minimum and maximum values in an array, string processing, iterative and recursive algorithms, building flowcharts of algorithms and developing programs based on them.	4		v													
14	Algorithms and Data Structures	The course covers the main approaches to the analysis and design of algorithms and data structures. The course covers topics such as worst-case asymptotic estimation of algorithm complexity, efficient algorithms for sorting and choosing order statistics, data structures (binary search trees, heaps, hash tables),	5		v													



		algorithm design techniques (divide and conquer, dynamic programming, greedy strategy), basic algorithms on graphs (shortest paths, topological sorting, connected components, minimum spanning trees).															
15	Databases	The course studies the basic concepts of data warehouses, types of storages. The course deals with practical aspects related to the definition of physical and conceptual data models, the differences between them and approaches to solving problems of building databases. Various types of data storage are discussed, algorithms for organizing effective access to data and delimiting access rights to data are studied. The main part of the course focuses on the relational data model and the SQL language.	5		v	v											
16	Introduction to Web programming	The course is designed to learn the basics of Web programming and Web application development. The course includes topics such as the basics of functioning, configuration and administration of software that implements Internet services; HTML 5 markup language; the basics of web page layout using CSS; fundamentals of the JavaScript language and	5			v											

		frameworks jQuery, AngularJS; basic web page design patterns; basics of server languages; database technologies.															
17	Discrete Mathematics	The course deals with the theoretical foundations of modern information technologies; methods of discrete mathematics (in particular, methods of combinatorics, relation theory, graph theory, mathematical logic) for formalizing and solving applied problems. This course explores the basic concepts of sets, relations, and functions in mathematical logic, group theory, theory of computation, probability, mathematical induction and recurrence relations, graph theory, trees, and Boolean algebra.	5	v				v									
18	Information security and data protection	The course is devoted to the main aspects of information security and is aimed at studying the theoretical foundations and practical use of information security systems in information systems, systematically gaining knowledge about the principles, methods and means of implementing data protection, acquiring practical skills in information security in information systems necessary for their design and operation.	5		v			v									
19	Computer graphics	The course studies the generation	5	v										v			

		of images on a computer, namely the mathematical and algorithmic foundations of computer graphics, raster graphics algorithms, 2D and 3D modeling, polygonal models. The technologies of using the OpenGL graphics library for generating 2D and 3D images, the use of auxiliary libraries are considered. After studying the discipline, students will be able to master any graphic tools, continue to study and use graphic libraries.																
20	Computer vision	Computer vision is the study of building computer systems that have a general high-level understanding of digital images or video and are designed to detect, track, and classify objects. From a practical standpoint, computer vision seeks to understand and automate the tasks that the human visual system can perform.	5				v								v			
21	Computer Networks	The program of the training course is aimed at familiarizing students with the basics of organization, construction, architecture and principles of functioning of computer networks. The course focuses on the application of skills to the organization of real networks and examines the communication tools, protocols and standards of networks. As a	5	v				v										

		result of mastering the discipline, students will learn how to configure and configure communication tools, select firewalls, and operate computer networks.															
22	Mathematics and Statistics	The course deals with mathematical models, methods and tools of linear algebra, mathematical analysis and probability theory, which are used in software engineering and the field of artificial intelligence. The issues of mathematical formalization of applied problems, the use of adequate mathematical tools in solving specific engineering and technical problems, mathematical modeling and interpretation of the obtained quantitative and qualitative results of solving these problems are considered.	5	v													
23	Mathematics I	The course is devoted to the study of the basic concepts of higher mathematics and its applications. The main provisions of the discipline are applied in the teaching of all general education engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an	5	v													

		introduction to analysis, differential calculation of functions of one and several variables. Methods for solving systems of equations, problems of using vector calculations in solving problems of geometry, mechanics, and physics are considered. Analytical geometry on a plane and space, differential calculation of functions of one variable, derivatives and differentials, study of the behavior of functions, derivative and gradient in direction, extremum of a function of several variables.															
24	Mathematics II	The discipline is a continuation of Mathematics I. sections of the course include integral calculus of a function of one variable and several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Certain integrals and their application. Incorrect integrals. Numerical series theory, functional series theory, Taylor and Macloren Series, application of series to approximate calculations.	5	v													
25	Объектно-ориентированное программирование	В курсе рассматриваются такие темы как: парадигма объектно-ориентированного программирования; классы и	5		v	v											

		<p>объекты; принципы создания масштабируемого программного обеспечения с использованием высокоуровневого метода проектирования понятий бизнес среды на языке программирования; языки программирования C++, Java и C#; принципы абстракций, инкапсуляции, наследования, полиморфизма; паттерны проектирования программного обеспечения; практические навыки создания программных продуктов.</p>															
26	Object oriented programming (Coursera)	<p>The course covers topics such as: the paradigm of object-oriented programming; classes and objects; principles of creating scalable software using a high-level method for designing business environment concepts in a programming language; programming languages C++, Java and C#; principles of abstractions, encapsulation, inheritance, polymorphism; software design patterns; practical skills in creating software products.</p>	5	v				v									
27	Web application development	<p>The course teaches the deployment of the NodeJS infrastructure, Angular, the creation of front-end applications using the JavaScript programming language. The</p>	6				v									v	

		course studies the classic jQuery library and its solutions in working with AJAX technology, NodeJS, which are the basis for implementing the server side of the front-end Web application. It also considers the Angular framework, which today occupies one of the leading positions in the development of the front part of Web applications.															
28	Physics	The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	5	v													
29	Application design patterns	The course is aimed at studying the main design patterns and the canonical library of typical design patterns. Discusses specific	5		v	v											

		problems and common design errors that developers face when writing code. The course covers information about how to decompose an application into layers, approaches to organizing business logic, the use and main aspects of the implementation of each solution under consideration, supported by examples of UML diagrams and source code.																
30	Training practice	The main purpose of the educational practice is the acquisition of practical experience by students in the field of computer science and information technology. The educational practice is intended for the formation of practical skills and professional training of students. The tasks of the practice include participation in software development projects, data analysis, testing, information systems support and other activities related to the field of Computer Science. Students study and apply modern methods and technologies used in the industry.	2	v	v												v	v
<b>Cycle of basic disciplines</b>																		
<b>Component of choice</b>																		
31	Data analysis	The course explores elementary statistical methods and applications to engineering	3				v											v



		problems, samples and populations, frequency distributions, probability theory, basic distributions, random sampling, point and interval estimation, hypothesis testing, and linear regression and correlation. The course examines the problems of data analysis in industry, their solutions using the Python programming language, and the evaluation of the quality of the solutions obtained.															
32	Design Thinking	The course is aimed at studying methods for the development of creative thinking, tools that provide engineering support for the processes of creating innovations, the formation of sustainable skills and abilities to use basic tools. The issues of system analysis of market needs, creation of consumer value by the method of design thinking, technologies for generating innovative solutions and checking the demand for solutions from the market through constant interaction with the end consumer are considered.	4	v	v												
33	Green technologies	The course is devoted to the study of the theoretical foundations of green technologies and the main segments of the green economy in	5	v							v	v					

		order to develop practical skills in the field of using the principles of the green economy. The course reveals the essence of green technologies. The directions of green technologies are considered: 1) the introduction of renewable energy sources; 2) improvement of the waste management system; 3) improvement of the natural resource management system; 4) development of "clean" transport.															
34	Huawei solutions	ICT	The course provides knowledge about information and communications technology (ICT) Huawei infrastructure. Huawei course is in accordance with the organization's "Platform + Ecosystem" development technique, and its new ICT infrastructure highlighting "Cloud-Pipe-Device" synergy. Huawei comprises ICT solutions such as ICT Infrastructure, Platform and Service with its driving ability advancement system.	5					v	v							
35	Intellectual data analys		The discipline "Intelligent Data Analysis" helps to form ideas about the types of problems arising in the field of Data Mining and methods of their solution that will help students to identify, formalize and successfully solve practical problems of data analysis, develop	5				v				v					

		theoretical knowledge, practical skills on the application of modern methods of data mining in various spheres of human activity.															
36	Information design	The course on information design deals with the development and creation of infographics for business, marketing, and advertising. The course will cover the following topics: Visual communication as the basis of information design; Business information tasks or visualization of data and concepts; Visualization of the main information flow; Principles for developing infographics; Formulation of ideas in the form of a visual representation; Business value of information design as the main means of internal and external communication.	4						v	v	v						
37	Multimedia technology	The course studies various editors for processing sound and video, creating animation effects and processing various graphic objects, creating multimedia presentations. The program direction of the course defines the range of issues related to the study of software tools designed to process sound, graphic and video information and the technology of working in them. The technical direction determines	5			v					v						

		the knowledge of the computer hardware used directly when working with sound and video.															
38	1C Programming	Within the framework of the course, a theoretical framework is given, and solutions to specific problems are considered. The objects that are used to implement the business logic of any solutions operating on the 1C:Enterprise platform are studied. Topics discussed include how to customize the system based on the needs of a particular organization, make changes to software solutions so that users can use them as efficiently as possible, tune databases, and update the system.	5		v					v	v						
39	Game Development	The course focuses on the basic methods of game design, development, documentation and implementation of the projects. The course begins with a description of the General ideas of the development of computer games, game documentation. The first considers the creation of two-dimensional games, their example explores fair for all kinds of games concept, the second focuses on working with three-dimensional graphics. Both blocks are completed with the analysis of a	5		v	v									v		

		fairly large-scale game project that demonstrates the interaction of technologies studied earlier.																
40	Mobile Application Development	The course is aimed at studying mobile application development techniques. The course examines the architecture of mobile applications, the basic components that make up a mobile application, the tasks solved by various components of mobile applications, the principles of layout of user interfaces of mobile applications, the specifics of mobile devices and their difference from desktop computers from the point of view of a developer of application software, software technical tools used to develop, debug and test mobile applications.	5			v												v
41	Start up and Technological Entrepreneurship	The purpose of studying the discipline is the formation of theoretical knowledge and practical skills in the field of technological entrepreneurship and management of innovative projects, namely their development, implementation and implementation. The course contains practical elements such as developing business models, conducting market research, implementing product development cycles and raising	4		v					v								v

		seed capital.																
42	IT project management	The purpose of mastering the discipline is to form professional competencies among students of effective IT project management, including the use of project management information systems. The course considers the following issues: basic methods and means of computer-aided design; modern standards and methods of project management; principles of standardization in the field of project management; purpose, functions and examples of project data management systems.	3			v		v										
43	Emotional artificial intelligence	The course studies the concept of emotional artificial intelligence (Affective computing & Social signal processing), methods for automatic recognition, analysis and synthesis of emotions and social behavior. The course provides basic concepts from psychology and computer science that are related to emotional artificial intelligence, knowledge of the methodology for automatic recognition, analysis and synthesis of emotions and social signals and forms practical skills for collecting and annotating data to build emotional artificial intelligence algorithms.	4	v														

44	Scientific Python	<p>The purpose of this discipline is the development of students such a powerful tool in data processing as the Python language and the library SciKit, which includes – NumPy – working with matrices, SciPy – data analysis tools, Matplotlib – data visualization tools. Currently, Python is recognized as the most common language programmed in data processing tasks. This is due to its simplicity and intuitive syntax, which abstracts the connection with the hardware of the computer with a strong emphasis on the creation of small efficient algorithms. The course provides a quick overview of the syntactic features of the language and its strengths.</p>	3	v	v														
45	CRM systems	<p>The course studies the basic concepts, categories and tools of modern CRM, the technical aspects of CRM systems, the features of the choice and integration of software products used in CRM projects, the basics of the work of analytical models for analyzing and predicting customer behavior. A special feature is its practical focus on studying examples of developing strategies and tools for managing customer</p>	5	v					v									v	

		relationships, as well as implementing CRM implementation projects in various industries.															
46	DevOps for application development	The course is aimed at learning such tools as Docker, Terraform, Ansible, Prometheus, kubernetes and Grafana. Students will learn how to write docker images, run containers, build dependencies and define access parameters, work with infrastructure as code, create, modify and version environments, work with version control systems, apply CI/CD principles, configure the layout of services in development environments and testing, automate processes, set up servers, and deploy applications.	3		v	v				v			v				
47	Fintech технологии	В курсе изучаются новые технологии, направленные на улучшение и автоматизацию предоставления и использования финансовых услуг. Курс включает вопросы о новых технологиях искусственного интеллекта и машинного обучения, которые используются в финансовой отрасли. Курс дает возможность определить новые технологии искусственного интеллекта, машинного обучения и финансовых технологий от	5		v					v							v



		различных компаний, занимающихся страхованием и недвижимостью, и их влияние на будущее финансов и инвестиций.																
<b>Cycle of profile disciplines University component</b>																		
48	Fintech technology	The course explores new technologies aimed at improving and automating the provision and use of financial services. The course includes questions about new technologies of artificial intelligence and machine learning that are used in the financial industry. The course provides an opportunity to identify emerging artificial intelligence, machine learning, and fintech technologies from various insurance and real estate companies and their impact on the future of finance and investment.	5		v	v												v
49	Databases and Application Development	The purpose of studying the discipline is the acquisition by students of solid knowledge and practical skills in the development of client-server applications. The discipline includes topics on the patterns of development of client-server applications, properties of information and features of information processes, the foundations of modern theories of	5		v		v											

		per-relational databases, features of using client-server technologies, analysis and modeling of the subject area in the client-server environment, related to the large-scale use of information - communication technologies in various fields of activity.																
50	Human Computer Interaction	The discipline dealing with the design, evaluation, and implementation of interactive computing systems for human use, and the study of the underlying phenomena involved in these matters. The main place is given to approaches, methods and tools for the formation and evaluation of the user interface. The procedures of iterative prototyping of the interface, types of prototypes, software packages for prototyping and their comparative capabilities are considered.	5		v			v									v	
51	NoSQL databases and application development	The purpose of studying the discipline is to study the main NoSQL databases: document-oriented, columnar, key-value, graph, etc. The course discusses the features of the built-in language of each type of database, methods for designing storage systems, methods for creating queries and optimizing them for execution speed, features modern	5		v	v	v											v

		NoSQL solutions and comparative analysis of relational and NoSQL approaches. Issues of ensuring reliability, fault tolerance and scalability of databases are discussed.															
52	Production practice I	The main purpose of production Practice I is to provide students with the opportunity to apply their knowledge, skills and abilities in a real working environment. The production practice is aimed at acquiring practical experience in the field of information technology and computer science. Production practice is carried out in companies and organizations engaged in software development, data analysis and other related fields. The objectives of the internship include students' participation in software development, data collection, processing and analysis, as well as solving specific technical problems.	2	v	v										v	v	
53	Production practice II	The main purpose of production Practice II is to provide students with work experience in the real information technology industry. Production practice is carried out in companies and organizations engaged in software development, data analysis and other related fields. The tasks of the practice include working in a team on real	3	v	v										v	v	

		projects, including programming, development, testing and optimization of software; participation in data collection and analysis, solving technical problems and the use of modern technologies; interaction with colleagues and managers, as well as participation in meetings and meetings.															
<b>Cycle of profile disciplines</b>																	
<b>Component of choice</b>																	
54	Analysis and processing of web data	The objectives of mastering the discipline are to form the formation of students' theoretical knowledge and practical skills for analyzing data received from the Internet. Within the framework of the goal set, the task of the academic discipline is to master theoretical knowledge and acquire practical skills for obtaining and processing data from sites of various contents, as well as interpreting the results obtained.	5			v						v					v
55	Business Intelligence	Within the framework of the discipline, the basics of Microsoft Business Intelligence, MS BI components (SSIS, SSAS, SSRS), architecture and user interface, analytical problem solving based on MS BI are studied. The course starts with basic concepts related to business intelligence and multidimensional modeling. To	5									v	v			v	

		create, edit, organize analytical queries to MS SQL, SSIS, integration service and SSRS, reporting service, the Microsoft BI user interface in Visual Studio and SSAS is used.															
56	Data Mining	The course explores methods and tools for extracting (mining) and integrating information from various data sources. Methods for extracting data about entities of the real world (such as individuals, companies, products, various objects of research) from texts and methods for programming the corresponding extractors in the algebraic language AQL, methods for comparing, grouping and parsing various differently structured representations of information about real world entities are considered.	5			v				v	v						
57	IT project management methodologies	The course is aimed at studying modern project management methods, their capabilities and limitations in relation to the needs of the content and environment of a particular IT project, industry or application. The course provides methodologies such as Agile, Waterfall, Scrum, Kanban, Scrumban, PRINCE2, Six Sigma, Critical Path Method, Critical Path Project Management, Lean	5						v							v	

		Management Methodology, Extreme Programming (XP).																
58	Big data analysis and processing methods	The course provides a foundational knowledge of the life cycle phases of big data analytics processes as a business transitions to big data. The course material provides knowledge of basic and advanced analytical methods and techniques used to search for and extract knowledge from large arrays of heterogeneous data. A comparison of various distributions of the Hadoop platform, "open source" and commercial tools used for storing, processing and analytics of big data is made.	5			v						v						v
59	Natural Language Processing	The course studies the theoretical and practical foundations of the theory of natural language processing. The course covers a wide range of applied tasks, including automatic translation, automatic summarization, generation of responses to user requests, information extraction, information retrieval, and sentiment analysis. The course also explores the theoretical aspects of NLP, including basic information from the field of linguistics, and practical methods for processing texts using the Natural Language ToolKit.	5		v		v											v

60	Digital Imaging Processing	The course is devoted to the classical methods of digital image processing, the study of linear spatially invariant systems, fast Fourier transform algorithms, algorithms for selecting the boundaries of image objects. The course contains information about the main methods of coding and processing of digital images, includes materials on the modern approach to image processing - wavelet analysis and discrete wavelet transform.	5		v	v							v				
61	Web Services Development	The purpose of the program is to develop knowledge, skills and abilities in the field of XML based web services development based on the Java SE platform. Discipline topics include development of relatively simple web services based on JAX-WS and JAX-RS, client applications for web services, deployment and launch of applications that include web services, the basic principles of the functioning of web services, the main technologies of the Java EE platform used in development of web services.	5			v						v					
62	Client-Server Applications Development	The purpose of the discipline is to study the fundamental principles of application operation in the client-server architecture;	5			v						v					v

		development of data storage and processing technologies in client-server architecture systems. The discipline includes the basics of new information technologies for the development of client-server software, the features of development, organization, distribution and monetization of client-server software, IDE writing code, project management systems, team communication systems, version control systems, the basics of object-oriented software decomposition technology systems, basic design patterns.															
63	Blockchain technologies	The purpose of mastering the discipline is to study blockchain technology, which allows the transfer and storage of digital assets in a decentralized way. In this course, the student will gain an understanding and knowledge of the basic concepts of blockchain technology, such as a transaction, block, block header and block chain, blockchain operations, verification, validation and consensus building, as well as the algorithms underlying the blockchain, as well as acquire the skills to develop and implementation of smart contracts,	5					v				v					



		get acquainted with the methods of developing decentralized applications for blockchain networks.															
64	Capstone project 1	The Capstone project 1 course teaches the research and development (R&D) cycle, starting with the stages of conceptual planning and analysis of an engineering project. Students practice in project documentation, formal project review presentations, oral defense of the project, and writing a final report. The course introduces the technical methods of analysis, design, prototyping, synthesis, troubleshooting and testing of an integrated system that includes several subsystems to create a software product.	5			v		v			v		v				
65	Capstone project 2	The Capstone project 2 course is a continuation of the Capstone project 1 course and serves as the culmination of an academic and intellectual experience for students. The course is aimed at applying the skills and knowledge gained in theoretical courses. The course demonstrates DevOps mastery by developing, testing, deploying, monitoring, and improving a secure application based on cloud microservices over	5			v		v			v		v				

		multiple sprints using a variety of Agile technologies and tools.																
66	IT infrastructure	The objectives of the discipline are teaching theory, methods and technologies in the field of development and management of IT infrastructure, management and development of IT infrastructure of various profiles and scales, as well as the formation of practical skills for the effective construction and modernization of IT infrastructure. Includes topics on modern technologies, methods and tools used in IT infrastructure management, IT infrastructure design methods for an enterprise, enterprise business architecture modeling, basic methods for modeling IT department business processes, optimizing the work of an IT department.	5					v			v			v				
67	UX/UI design	The course covers UX design, the concept of design thinking, and UX research. The course is aimed at studying the user of the software product, User-flow, Use-cases. The methods of prototyping using characters, general principles of interface design, design methods, site design, site typology, E-commerce, working with forms, mobile application development, text in the interface, Front-end for	5					v			v						v	

		the designer, Visual Design, the basics of proper communication for designer, communication with the client, communication within the team, organization of the UX process, presentation of the UX project, portfolio design are considered.																	
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## 5. Curriculum of educational program

NON-PROFIT JOINT STOCK COMPANY «KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY» NAMED AFTER K.I.SATBAYEV



**CURRICULUM**  
 of Educational Program on enrollment for 2023-2024 academic year  
 Educational program 6B06102 "Computer Science"  
 Group of educational programs B057 "Information technologies"

Form of study: full-time Duration of training: 4 years Academic degree: bachelor's degree in information and communication technologies

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lek/lab/pr	SIS (including TSIS) in hours	Form of control	Distribution of classroom classes by courses and semesters											
								I course		II course		III course		IV course					
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester				
<b>CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)</b>																			
<b>M-1. Module of language training</b>																			
LNG108	Foreign language	GED, RC	10	300	0/0/6	210	E	5	5										
LNG104	Kazakh (russian) language	GED, RC	10	300	0/0/6	210	E	5	5										
<b>M-2. Module of physical training</b>																			
KFK101-104	Physical culture	GED, RC	8	240	0/0/8	120	Difcredit	2	2	2	2								
<b>M-3. Module of information technology</b>																			
CSE677	Information and communication technology	GED, RC	5	150	2/1/0	105	E	5											
<b>M-4. Module of socio-cultural development</b>																			
HUM137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5											
HUM132	Philosophy	GED, RC	5	150	1/0/2	105	E			5									
HUM120	Module of socio-political knowledge (sociology, political science)	GED, RC	3	90	1/0/1	60	E			3									
HUM134	Module of socio-political knowledge (cultural studies, psychology)	GED, RC	5	150	2/0/1	105	E				5								
HUM136	Fundamentals of anti-corruption culture and law	GED, CCH	5	150	2/0/1	105	E				5								
MNG489	Fundamentals of economics and entrepreneurship				2/0/1														
ELC577	Fundamentals of scientific research methods				2/0/1														
CHE656	Ecology and life safety				2/0/1														
<b>CYCLE OF BASIC DISCIPLINES (BD)</b>																			
<b>M-5. Module of physical and mathematical training</b>																			
MAT101	Mathematics I	BD, UC	5	150	1/0/2	105	E	5											
PHY468	Physics	BD, UC	5	150	1/1/1	105	E	5											
MAT102	Mathematics II	BD, UC	5	150	1/0/2	105	E		5										
CSE505	Discrete Mathematics	BD, UC	5	150	1/0/2	105	E			5									
CSE608	Mathematics and Statistics	BD, UC	5	150	2/1/0	105	E				5								
<b>M-6. Module of basic programming training</b>																			
CSE662	Introduction to Web programming	BD, UC	5	150	1/1/1	90	E		5										
CSE554	Algorithmization and programming basics	BD, UC	4	120	1/1/1	75	E		4										
CSE678	Algorithms and Data Structures	BD, UC	5	150	1/1/1	105	E			5									
CSE540	Web application development	BD, UC	6	180	1/1/2	120	E				6								
CSE127	Object oriented programming	BD, UC	5	150	1/1/1	105	E			5									
<b>M-7. Basic training module on computer systems</b>																			
CSE681	Operating systems	BD, UC	5	150	1/1/1	105	E				5								
CSE507	Application design patterns	BD, UC	5	150	1/1/1	105	E				5								
CSE122	Computer Networks	BD, UC	5	150	1/1/1	105	E					5							
CSE679	Databases	BD, UC	5	150	1/1/1	105	E				5								
<b>M-8. Software basic training module</b>																			
CSE536	Computer graphics	BD, UC	5	150	1/1/1	105	E			5									
SEC162	Information security and data protection	BD, UC	5	150	2/1/0	105	E				5								
CSE538	Computer vision	BD, UC	5	150	1/1/1	105	E									5			
CSE530	1C Programming	BD, CCH	5	150	1/1/1	105	E							5					
CSE525	Intellectual data analysis				1/1/1														
CSE801	IT project management	BD, CCH	3	90	1/0/1	45	E							3					
CSE802	Data analysis				1/0/1														
AAP101	Training Practice	BD, UC	2							2									
<b>M-9. Module of additional training in modern information technologies</b>																			
CSE428	Multimedia technology	BD, CCH	5	150	2/1/0	105	E							5					
CSE457	Game Development				1/1/1														
CSE526	Fintech technology				1/1/1														
CSE527	Green technologies				1/1/1														
CSE509	Mobile Application Development	BD, CCH	5	150	1/1/1	105	E							5					
CSE529	Huawei ICT solutions				1/1/1														
CSE531	CRM systems				1/1/1														
<b>CYCLE OF PROFILE DISCIPLINES (PD)</b>																			
<b>M-10. Module of profiling training in software and artificial intelligence</b>																			
CSE178	Machine Learning	PD, UC	5	150	1/1/1	105	E				5								
CSE559	Human Computer Interaction	PD, UC	5	150	1/1/1	105	E						5						
CSE694	Databases and Application Development	PD, UC	5	150	1/1/1	105	E						5						
CSE698	NoSQL databases and application development	PD, UC	5	150	1/1/1	105	E									5			
CSE699	Client-Server Applications Development	PD, CCH	5	150	1/1/1	105	E									5			
CSE651	Natural Language Processing				1/1/1														
CSE503	Web Services Development	PD, CCH	5	150	1/1/1	105	E									5			
CSE690	Analysis and processing of web data				1/1/1														

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«KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATBAYEV»

CSE513	UX/UI design	PD, CCH	5	150	1/1/1	105	E									5			
CSE533	Big data analysis and processing methods				1/1/1														
CSE516	IT infrastructure	PD, CCH	5	150	1/0/2	105	E										5		
CSE496	Data Mining				2/1/0														
CSE691	Blockchain technologies	PD, CCH	5	150	2/0/1	105	E										5		
CSE517	Digital Imaging Processing				1/1/1														
<b>M-11. R&amp;D module</b>																			
CSE804	Design Thinking	BD, CCH	4	120	0/0/3	75	E									4			
CSE803	Information design				0/0/3														
CSE510	Start up and Technological Entrepreneurship	BD, CCH	4	120	1/0/2	75	E										4		
CSE813	Emotional artificial intelligence				1/0/2														
CSE561	Capstone project 1	PD, CCH	5	150	0/0/3	105	E									5			
CSE643	Business Intelligence				1/1/1														
CSE562	Capstone project 2	PD, CCH	5	150	0/0/3	105	E										5		
CSE811	IT project management methodologies				1/0/2														
CSE812	DevOps for application development	BD, CCH	3	90	1/0/1	45	E										3		
CSE816	Scientific Python				1/0/1														
CSE556	Production practice I	PD, UC	2											2					
CSE557	Production practice II	PD, UC	3													3			
<b>M-12. Module of final attestation</b>																			
ECA108	Final certification	FC	8														8		
<b>M-13. Module of additional types of training</b>																			
AAP500	Military affairs	ATT	0																
<b>Total by UNIVERSITY:</b>												32	28	31	29	30	30	30	30
												<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>


Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
		required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		87	29	116
PD	Cycle of profile disciplines		25	35	60
	<b>Total for theoretical training:</b>	<b>51</b>	<b>112</b>	<b>69</b>	<b>232</b>
FC	Final attestation	8			8
	<b>Total:</b>	<b>59</b>	<b>112</b>	<b>69</b>	<b>240</b>

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 5 "24" november 2022 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 3 "17" november 2022 y.

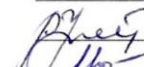
Decision of the Academic Council of the Institute Automation and Information Technologies. Protocol № 2 "20" september 2022 y.

Governing Board member - Vice-Rector for Academic Affairs



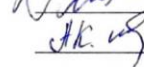
B.A. Zhautikov

Institute Director Automation and Information Technology



R.K. Uskenbayeva

Department Head "Software Engineering"



A.N. Moldagulova

Representative of the Council from employers



A.T. Konysbayev