MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
NON-PROFIT JOINT STOCK COMPANY
"ALMATY UNIVERSITY OF ENERGY AND COMMUNICATION"
INSTITUTE OF CONTROL SYSTEMS AND INFORMATION TECHNOLOGIES

"Agreed"
President of the Association
of Innovative Companies SEZ "PIT"
_____ Konysbayev A.
«14» 04 2020

"Approved"
Rector of AUPET
_____ S. Sagintayeva
«14» 04 2020

MODULAR EDUCATIONAL PROGRAM
DIRECTION 6B06101 - COMPUTER SCIENCE
HIGHER EDUCATION

Area of education (according to the classifier dated 10/13/2018): 6B06 - Information and communication technology
Direction of study (according to the classifier dated 10/13/2018): 6B061 - Information and communication technology

Duration of study - 4 years
Awarded academic degree: *bachelor of natural science*
Qualification level in accordance with the National Qualifications Framework: Level 6.

Almaty 2020

Training trajectories (specialty):

-software engineering;

- computer engineering.

The EP is developed on the basis of: the National Qualifications Framework, Approved by the protocol of March 16, 2016 by the Republican tripartite commission on social partnership and regulation of social and labor relations; Sectoral qualifications framework "Information and communication technologies", Approved by the protocol of the meeting of the Sectoral Commission in the field of information, informatization, communications and telecommunications dated December 20, 2016 No. 1; State compulsory standard of higher education, Approved by the Decree of the Government of the Republic of Kazakhstan dated 08.23.2012 No. 1080 (amended by the decree of the Government of the Republic of Kazakhstan. Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 604. Registered in the Ministry of Justice of the Republic of Kazakhstan from November 1, 2018 No. 17669.); Professional standards or standard projects.

The educational program was developed at the IT Engineering Department.

Head of the educational program Mussatayeva G.T.

In the development of the educational program participated: Amanbayev A.A., Ph.D., associate professor.

The EP was reviewed and approved at a meeting of the IT Engineering Department on 04/03/2020, protocol No. 8.

Head of IT Engineering Department _____ Doszhanova A.A.

The EP was reviewed and approved at a meeting of the educational and methodical commission of the Institute of Control Systems and Information Technologies (protocol No.8 from 05/03/2020).

Director of ICSIT _____ Kartbayev T.S.

The EP was reviewed and approved by the Scientific and Methodological Council of AUPET (protocol No. 12 dated 14/04/2020).

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List of symbols and abbreviations

HE	- Higher education
STSE	- State Compulsory Standard of Education
EQF	- European Qualifications Framework
NCO	- National classifier of occupations
RK	- Republic of Kazakhstan
NQF	- National Qualifications Framework
NQS	- National Qualifications System
GEM	- General educational module
EP	- Educational program
GED	- General educational disciplines
CC	- Compulsory component
UC	- University component
BD	- Basic disciplines
PD	- Profile disciplines
IEP	- Individual educational path
SQF	- Sectoral Qualifications Framework
PS	- Professional standard
PGE	- Postgraduate education
ON	- Competencies
LO	- Learning outcome
CW	- Course work
CGW	- Calculation and graphic work
RWS	- Research work of students
CED	- Catalog of elective disciplines

Educational program passport

№	Field name	Notes
1	Registration number	6B06100043
2	Code and classification of the field of education	6B06 Information and communication technology
3	Code and classification of training areas	6B061 Information and communication technology
4	Group of educational programs	B057 - Information Technology
5	Name of educational program	6B06101 – Computer Science
6	Type of EP	Current EP
7	Purpose of EP	Prepare qualified specialists to solve problems of design, development, implementation and operation of information systems and a wide class of technologies based on the principles of performance, reliability and security.
8	ISCE level	ISCE 6 Baccalaureate or its equivalent
9	NQF level	6
10	SQF level	6
11	Distinctive features of EP	No
	Partner university (JEP)	No
	Partner university (AEP)	No
12	The list of competencies	ON-1. Apply social and ethical values in practice; know the basics of the language, history, legal system of the Republic of Kazakhstan, observe the norms of culture and business ethics. ON-2. Apply mathematical, numerical, high-performance computing, decision-making methods, modeling for various processes. ON-3. Master the physical processes of computer systems and apply architectural solutions in the design of information systems and their components. ON-4. Apply innovative ICT and software products, algorithms and methods of information security in their professional activities. ON-5. Own tools, environment, modern programming technologies, develop software and functional support for information systems. ON-6. To carry out design, configuration, testing and maintenance of computer networks and to ensure their safety. ON-7. Apply artificial intelligence, design and develop ergonomic user interfaces, manage projects. ON-8. Develop a system for collecting, storing, analyzing, and managing data using BigData, DataMining, and cloud computing technologies (Appendix 1).
13	Learning outcomes	
14	Form of learning	Full-time, distance
15	Language of learning	Russian, Kazakh, English
16	Credits	240

17	Awarded Academic Degree	Bachelor in the field of information and communication technologies on the educational program “6B06101 - Computer Science”
18	Availability of an appendix to the license for the training	License № 0137445 Date of issue 08/04/2010
19	Availability of accreditation of EP	Yes
	Name of accreditation body	IAAR Non-profit organization "Independent agency for accreditation and rating"
	Accreditation Duration	05.04.2019-04.04.2024
20	Information about disciplines	Information about disciplines of UC/OC GED, BD, PD (Appendix 1)
21	Professional activity	industry, science, education, culture, healthcare, agriculture, public administration.
22	Types of professional activity	design and engineering; production and technological; organizational and managerical; operational; pedagogical.
23	Modular Curriculum	Given in appendix 2

1. The structure of the educational program of higher education

Bachelor's degree - the level of higher education aimed at training personnel with the award of a "bachelor" degree on the relevant educational program with the obligatory mastering of at least 240 academic credits. The content of the educational program of higher education consists of three cycles of disciplines - general education disciplines (hereinafter - GED), basic disciplines (hereinafter - BD) and profile disciplines (hereinafter - PD).

The GED cycle includes disciplines of the compulsory component (hereinafter - CC), the university component (hereinafter - UC) and (or) the optional component (hereinafter - OC). BD and PD cycles include UC and OC disciplines.

The list of GED cycle does not allow a reduction in the volume of disciplines of the compulsory component, the content of which is determined by standard educational programs. The exception is shortened educational programs of higher education with accelerated terms of study on the basis of technical and vocational, post-secondary or higher education.

UC and OC are determined independently by the university and take into account the needs of the labor market, the expectations of employers and the individual interests of the student.

The volume of the GED cycle is not more than 23% of the total educational program of higher education or 56 academic credits. Among them, 51 academic credits are allocated to the disciplines of the compulsory component.

The BD cycle includes the study of academic disciplines and the passage of professional practice and is at least 47% of the total educational program of higher education or at least 112 academic credits.

The PD cycle includes academic disciplines and types of professional practices, the volume of which is at least 25% of the total educational program of higher education or at least 60 academic credits.

The modular curriculum meets the requirements of the state compulsory standard of higher education and the structure of the educational program of higher education, contains all the components of the compulsory part, and has university and optional components. In the modular program, the minimum requirements for the number of credits for theoretical training are -228 and 12 credits for final certification. Terms and types of practices in the educational program are defined as: educational - 1 semester (3 credits), production - 4 semesters (5 credits) and 6 semesters (5 credits), pre-diploma - 8 semesters (8 credits). The optional component is defined in the catalog of elective disciplines.

Appendix 1
to the State Compulsory
Standard of Education

The structure of the educational program of higher education

No.	The name of the cycles of disciplines and activities	Total labor input	
		in academic hours	in academic credits
1	2	3	4
1.	General education disciplines cycle (GED)	1680	56
1)	Compulsory component	1530	51
	The modern history of Kazakhstan	150	5
	Philosophy	150	5
	Foreign language	300	10
	Kazakh (Russian) language	300	10

	Information and communication technologies (in English)	150	5
	The module of socio-political knowledge (sociology, political science, cultural studies, psychology)	240	8
	Physical Culture	240	8
2)	University component and(or) Optional component	150	5
2.	Basic disciplines cycle (BD)	3360	112
1)	University component	180-1680	6-56
2)	Optional component	Not least than 1680	Not least than 56
3.	Profile disciplines cycle (PD)	1800	60
1)	University component and(or) Optional component	1800	60
4.	Additional types of education (ATE)		
1)	Optional component		
5.	Final examination (FE)	360	12
	Preparation and defense of a diploma work and preparation and passing a comprehensive exam	360	12
	TOTAL	7200	240

2. Catalog of Elective Disciplines

The catalog of elective disciplines is formed for the entire period of study, but it is not static, and can be changed in accordance with the needs of production, the desire of a group of students (at least one subgroup), academic exchange of teaching staff and the opportunity to listen to a modern professional course, leading specialists, leading universities of the world.

CED is developed and issued as a separate document.

3. Modular curriculum

The modular curriculum is presented in Appendix 2. The effectiveness of learning outcomes is achieved by observing a comprehensive approach, when the educational programs and the curriculum and educational disciplines are formed on a modular basis.

The content and volume of each module varies depending on the didactic purposes, profile and level differentiation of students, and the entire educational program is structured into autonomous organizational and methodological modules.

The formation and content of the modules provides the necessary degree of flexibility and freedom for students in selecting a training path and obtaining special professional competencies that increase competitiveness in the labor market.

Modules of the educational program 6B061 – Computer Science are either compulsory or variative with the required disciplines of the university component.

4. Path selection method

Until the fourth year, the modules have a "horizontal-vertical" scheme. Modules consist of a compulsory and variative component. Learning outcomes after studying the module may vary depending on the selected variative component of the module. The variative part leaves the possibility of changing the learning path up to the 7th semester. From the 7th semester, the student studies modules in a specific direction and the variative component of the modules studied in earlier semesters.

Such a scheme for the formation of an educational program gives a student freedom in choosing the disciplines listed in the catalog of elective disciplines and in a modular curriculum, each student's personal participation in the formation of their individual curriculum, and the involvement of academic consultants to the educational process that assist students in choosing an educational path.

As a result of the implementation of the chosen educational path, the necessary competencies must be obtained. An individual educational path consists of a compulsory one, including a university component, variative, corrective, and organizational parts. The compulsory part includes the basic modules for the study, which correspond to the state compulsory standard of higher education. The university component of the modules is studied obligatory, regardless of the chosen path and forms the basic "General Professional" and "Professional" competencies of the future specialist. The variative part includes a set of modules and their components, which the student selects for study, depending on the areas of study that interests him. The compulsory and variative parts are aimed at determining the content of learning. The corrective part provides assisting students in the selection of disciplines of the variative part of modules and variative modules taking into account their individual characteristics, as well as determining the organizational part. The organizational part includes the following system components: forms, methods, technologies, tools, monitoring the study of selected content. Table 4.1 presents the organizational components of IEP training.

Table 4.1 - Organizational components of IEP training

Elements of asynchrony	Providing asynchronous learning	Tools providing asynchrony
Individual work of a student The choice of disciplines of the variative component Work on projects The choice of an additional training profile	Institute of Management Systems and Information Technologies	Working curriculum; Timetable of classes; Schedule of consultations of teachers of IWM; curriculum monitoring
	Advisors, Tutors	Individual curriculum of a student
	Techers	EMDC, schedule of completion of tasks, bibliography, handout, electronic resource
	Students	Library, media library, electronic publications, Internet, syllabuses

Table 4.2 presents the substantive component of IEP training. The content component specifies the variants for the formation of individual educational technology. As a part of the educational program, it is possible to implement academic mobility and receive additional education.

Table 4.2 Substantive component of IEP training

IEP variants	Providing asynchronous learning	Tools providing asynchrony
Individual competency set	Advisors, students	Individual curriculum of a student
	Departments	A set of variative disciplines
	IMSIT	Working curriculum

Concretization of the training profile (CGW, TW, research work, project work)	Advisors, students	Individual curriculum of a student
	Departments	Exemplary topics for TW, CGW topics, RWS topics
Individual level of mastering disciplines (high, medium, low)	Advisers, students, teachers	Regulations on the ball-rating assessment system, schedule of tasks completion, experimental research work
Professional adaptation to professional activities during the practice	Advisors, students, departments, dean's office	Practice programs, agreements with enterprises on the bases of practices, the formation of individual tasks for practice, elements of dual learning
An expanded set of professional competencies (selection of an additional training profile)	Advisors, students	Individual plan of a student
	IMSIT	Non-linear schedule, the main educational program of an additional learning profile, professional advanced training courses

The first course is characterized by a significant number of compulsory disciplines and disciplines of the university component included in the modular plan. In the first year, there are no disciplines of the variative component. After studying the disciplines of the first and second semester, students will master 30 credits in the first semester and 30 credits in the second semester. In the first semester, educational practice is provided.

In the second year, the study of the general and basic disciplines cycles continues. The share of the variative part in the second year is significant. In the second year, the formation of a future profession begins; a significant proportion of disciplines is devoted to the theoretical foundations of systems analysis, the basics of information systems, the study of programming languages, etc. The choice of disciplines of the variative component does not affect the choice of the direction of preparation of the educational program, but forms the basic knowledge associated with information systems.

Therefore, after the selection of the disciplines of the third and fourth semester, students will master 30 credits in the third semester and 30 credits in the fourth semester. In the fourth semester, five credits for production practice 1 must be mastered.

In the third year, the study of the disciplines of the basic disciplines cycle continues, but a rather large block of profile disciplines appears, both of the compulsory and the variative component. The proportion of the variative part in the third year is significant. In the third year, there is the beginning of the formation of a future profession in the modules MInf-11 Database Theory, MInf12-1 Internet-entrepreneurship, MInf12-2 Fundamentals of geographic information technologies, MInf12-3 3D modeling technologies and augmented reality.

Disciplines of the university component appear that are inherent to a particular area of training of a future specialist, from these disciplines it is necessary to choose the discipline that lays the foundation for specialization. After selecting the disciplines of the fifth and sixth semester, students will master 30 credits in the fifth semester and 30 credits in the sixth semester. In the sixth semester five credits for production practice 2 must be mastered.

In the fourth year, the study of the basic and profile disciplines cycles of the variative and university component continues. In the seventh semester, the study of the disciplines of a specific area of future specialist training begins (MInf-11 IT-project management, MInf12-1 Knowledge representation in information systems, MInf12-2 Design of geographic information systems, MInf12-3 Computer game development). The study of these modules is compulsory at selecting a training path (specialization). In the eighth semester, the general and basic disciplines of the university component are studied: Economics, entrepreneurship and industry management, Ecology and life safety, Professional Kazakh (Russian) language, Professionally-oriented foreign

language, as well as preparation for final certification, which completes the educational process on educational program.

Therefore, after selecting the disciplines of the seventh semester, students will master 30 credits. In the eighth semester, in addition to studying a number of disciplines, there must be mastered pre-diploma practice and final certification, a total - 30 credits.

The volume of mastered credits by modules and training courses is presented in summary table 4.3.

By forming additional modules in the third and fourth courses in the university part of the program, you can train specialists in a wide variety of specializations, keeping up with the times.

The educational program ensures the application of an individual approach to students, ensures the transformation of professional competencies from professional standards and qualification standards into learning outcomes. Student-centered learning is provided - the principle of education, which implies a shift in emphasis in the educational process from teaching (as the main role of teaching staff in the knowledge "translation") to learning (as the active educational activity of the student). The educational program is designed to implement the principles of the democratic nature of educational management, expanding the boundaries of academic freedom and the authority of educational institutions, which will ensure the training of highly motivated personnel in the field of information technology, in particular in the field of information technology systems design.

Table 4.3 - A summary table reflecting the amount of mastered credits by modules of the educational program

Curriculum	Semester	The number of mastered modules	Number of disciplines		Number of credits KZ					Total in hours	ECTS	Amount	
			CC	OC	Theoretical training	Training practice	Production practice	Final certification	Total			examination	Differential credit
1	1	6	5	3	30	0	0	0	30	900	30	5+1 Гос	2
	2	5	4	3	27	3	0	0	30	900	30	6	1
2	3	6	3	4	30	0	0	0	30	900	30	6	1
	4	4	1	6	30	0	0	0	30	900	30	5	2
3	5	6	0	6	30	0	0	0	30	900	30	6	0
	6	4	0	7	25	0	5	0	30	900	30	6	1
4	7	5	0	6	30	0	0	0	30	900	30	6	0
	8	2	0	5	10	0	8	12	30	900	30	4+1 Гос+ +ДП	1
Total			13	40	212	3	13	12	240	7200	240	44+2Гос +ДП	8

Application 1

Table A1.1 - Information about the studied disciplines and formed competencies

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
The cycle of general education University component / Component of choice				
1	Modern history of Kazakhstan	As a result of studying the discipline "Modern History of Kazakhstan", students should understand the most important periods and events in the history of Kazakhstan, master the ability to analyze the key problems of Natural History and the ability to navigate in the historical space.	5	ON1
2	Foreign language 1	As a result of studying the discipline "Foreign Language", students must master a foreign language at a high professional level, sufficient for professional interaction with foreign colleagues, as well as for searching, studying and analyzing foreign sources of information.	5	ON1
3	Foreign language 2	As a result of studying the discipline "Foreign Language", students must master a foreign language at a high professional level, sufficient for professional interaction with foreign colleagues, as well as for searching, studying and analyzing foreign sources of information	5	ON1
4	Kazakh (Russian) language	As a result of studying the “Kazakh (Russian) language” discipline, students will master the skills of working with authentic texts, master the language system and how to use it, and demonstrate in Russian as a language of interethnic communication written and oral communication skills in various areas of life (social, everyday,	5	ON1
5	Kazakh (Russian) language	As a result of studying the “Kazakh (Russian) language” discipline, students will master the skills of working with authentic texts, master the language system and how to use it, and demonstrate in Russian as a language of interethnic communication written and oral communication skills in various areas of life (social, everyday, socio-political, educational and vocational).	5	ON1
6	Information and communication technologies (in English language)	In the result of the study of the discipline "Information and communication technologies" students will master information and communication competencies that will facilitate everyday life and provide an opportunity to use modern information technologies in various fields of professional activity, scientific and practical work, for self-educational and other purposes.	5	ON1
7	Module of socio-political knowledge(sociology, political science)	As a result of studying the discipline, students will acquire the necessary knowledge about the cultural development of society, about the cultural heritage of their country, as well as they will form an understanding of the laws governing the development of political processes, the place and role of politics in public life, and the features of political relations in the modern world.	2	ON1
8	Module of socio-political knowledge (cultural studies, psychology)	As a result of studying the discipline, students will receive the skills and abilities to reasonably and reasonably provide information on various stages of development of Kazakhstan's society, social and interpersonal relations, to develop programs for solving conflict situations in society, including in professional society.	3	ON1
9	Philosophy	As a result of studying the “Philosophy” discipline, students will master general cultural and professional competences, namely, learn to perceive, analyze and understand philosophical, socially and personally significant philosophical problems, learn basic skills of analytical reading of texts using traditional methods and modern information technologies.	5	ON1

10	Economics, entrepreneurship,leadership and innovation	As a result of studying this discipline, students should master the competences of a comprehensive socio-economic analysis of complex and dynamically developing processes and systems, master the skills to apply their knowledge to build an effective business creation system, reasonably solve problems, demonstrate knowledge and understanding in economics and production management in Kazakhstan.	2	ON1
11	Ecology and life safety	As a result of studying the discipline "Ecology and LS" students should master the basics of general ecology and the concept of sustainable development, the ability to apply them in the analysis of current environmental problems, as well as competently and skillfully carry out their activities on BC in an enterprise, regardless of the information system industry, to preserve health , the performance of workers in the process of employment.	2	ON1
12	Law and the basics of anti-corruption culture	As a result of the study of the discipline "Law and the basics of anti-corruption culture," students will master the knowledge of legal and ethical standards for their use in professional activities; gain comprehensive knowledge of the nature and factors of corruption; develop the legal culture of the individual, contributing to the fight against corruption; gain knowledge, skills and abilities to counter corruption and critical analysis of corruption phenomena.	1	ON1
13	Physical culture 1	As a result of active participation in the passage of this discipline, students learn to be committed to a healthy lifestyle, improve their sporting achievements and will be aimed at the proper level of physical training necessary for an active professional activity.	1	ON1
14	Physical culture 2	As a result of active participation in the passage of this discipline, students learn to be committed to a healthy lifestyle, improve their sporting achievements and will be aimed at the proper level of physical training necessary for an active professional activity.	2	ON1
15	Physical culture 3	As a result of active participation in the passage of this discipline, students learn to be committed to a healthy lifestyle, improve their sporting achievements and will be aimed at the proper level of physical training necessary for an active professional activity.	3	ON1
16	Physical culture 4	As a result of active participation in the passage of this discipline, students learn to be committed to a healthy lifestyle, improve their sporting achievements and will be aimed at the proper level of physical training necessary for an active professional activity.	2	ON1
The cycle of basic disciplines University component				
17	Mathematics 1	Introduction to the fundamental sections of higher mathematics: elements of linear algebra and analytical geometry: determinants, matrices, systems of linear equations, vectors, straight and plane equations, second-order curves; differential and integral calculus of functions of one variable: limit of a function, continuity, derivative of a function, primitive, definite integral and complex numbers.	5	ON2
18	Physics	Mastering the laws of mechanics, molecular physics, thermodynamics; electricity and magnetism; Maxwell's equations; physics of vibrations and waves; quantum physics and atomic physics; solid state physics; atomic nucleus and elementary particles, necessary for the development of other disciplines of physical, mathematical and technical profile, as well as in professional activities.	5	ON3
19	Mathematics 2	Introduction to the fundamental sections of higher mathematics: differential and integral calculus functions of several variables: partial derivatives, full differential and its relation to partial derivatives, extremes of functions of several variables, multiple integrals; differential equations: differential equations of the first and higher orders; series theory: numerical series, functional series,	5	ON2

		Fourier series.		
20	(Educational practice) Computer Graphics Basics	They will master computer geometry, raster and vector graphics, acquire skills in working with graphic libraries and in modern graphic packages and systems, interactive animation (Adobe Animate), cinematic visual effects and motion graphics (After Effects), video editing and editing (Adobe Premiere) , audio recording, mixing and restoration, etc.	3	ON4
21	Professional Kazakh (Russian) language	As a result of studying the discipline, students will master linguistic professional competences that integrate general cultural, intellectual, social and professional qualities specialist; they will master the skills of applying special vocabulary in the professional sphere, reproducing and analyzing the text of general technical and highly specialized topics, producing their own text in the written / oral communication, professional communication and public speaking in the state (Russian) language.	3	ON1
22	Professionally-oriented foreign language	Discipline is aimed at developing speech skills of oral and written communication in a foreign language, reading and translating texts in the specialty, producing monologic statements in compliance with the rules of speech etiquette. As a result, students will master the skills and knowledge of word-formation models, the contextual meanings of polysemantic words, terms, lexical structures, as well as the grammar and syntax of a technical language.	3	ON1
23	Basics of algorithmization and programming	Obtaining necessary knowledge in the field of creation of flowcharts and algorithms. Studying of bases of programming in language C in the environment of Visual Studio. Realization in the program code of algorithms with linear and nonlinear structure. This discipline is basic for studying of the STL language (it is intended for programming of industrial controllers).	5	ON5
24	Mathematical modeling	The solution of mathematical and engineering problems of mathematical modeling, algorithmization, programming in the field of IP, and the possibility of their development in other disciplines in the implementation of the concept of the basis of programming in the field of applied engineering problems.	5	ON2
25	Operating system	The training of highly qualified specialists who possess the skills to use modern operating systems in the professional field. The topics cover basic knowledge regarding the interaction of the OS with the computer system hardware and networks, describes the work in the kernel mode and the user mode, outlines the main approaches to the design and development of the OS.	5	ON4
26	Computer network	Formation of ideas about the purpose, composition, principle of construction and functioning of computer networks, understanding the sources of effective use of computer networks, tools for building and methods of effective use of computer networks, the acquisition of knowledge about network technologies and skills that can be applied at the beginning of work as a network specialist.	5	ON6
27	Internship 1	As a result of practical training, students will gain practical skills in drawing up, monitoring the work plan, planning the resources required for work, the ability to analytically approach solving tasks, work in a team and independently, evaluate the results of their own work, draw up the results obtained in the form of reports and software documentation.	5	ON3, ON4, ON5
28	Internship 2	As a result of practical training, students will gain practical skills in drawing up, monitoring the work plan, planning the resources required for work, the ability to analytically approach solving tasks, work in a team and independently, evaluate the results of their own work, draw up the results obtained in the form of reports and software documentation.	5	ON3, ON4, ON5, ON6, ON7, ON8
Cycle of basic disciplines Component of choice				

29	Administration of high-performance computing systems based on Linux	The main commands of Linux OS, configuration of static and dynamic IP addressing in Linux OS, virtualization, RAID technology, DHCP server, firewall, creation of VLAN, Network Time Protocol, domain name system (DNS), web server (Apache/Nginx), proxy server (Squid), mail server, file server, Storage Area Network (SAN), PPTP Protocol, monitoring.	5	ON6
30	Administration of high-performance computing systems based on Windows	Virtualization, RAID technology, DHCP server, firewall, Network Time Protocol, domain name system (DNS), web server (IIS), proxy server, mail server, file server, Storage Area Network (SAN), Active Directory, monitoring.	5	ON6
31	Requirements Analysis and Systems Design	Using object-oriented programming. MVC. Microsoft .NET initiative. Problems with compatibility, reliability, and reuse of components. NET Framework. The common language runtime CLR. Class library .NET Framework. Implementation of XSL, XPath, and other tools for working with the XML data representation language using PHP, C#, and application development tools, including Web applications using Java.	5	ON5
32	Architecture of computing systems	Mastering the basic principles of the organization and functioning of computer and telecommunication systems for various purposes, the acquisition of knowledge for the construction, configuration and administration of computer systems and networks. The use of collective learning methods, student-centered, problem, modular and differentiated learning technologies.	5	ON3
33	Architecture and organization of computer systems	Mastering the basic principles of the organization and functioning of computer and telecommunication systems for various purposes, the acquisition of knowledge for the construction, configuration and administration of computer systems and networks. The use of collective learning methods, student-centered, problem, modular and differentiated learning technologies.	5	ON3
34	Human-computer interaction	Examine the mechanisms of human perception and processing of information, basic characteristics and limitations of the human user, the basic concepts and models of modern human-machine interfaces, industrial and corporate standards, methods for solving standard design problems and assessing the quality of HMI.	5	ON7
35	Component approach in programming	Software quality and control methods. Software architecture. Design samples. The principles of creating a convenient user interface. The basic constructs of Java and C #. Component technologies and distributed software development. Component technologies for web application development. Developing different levels of web applications in J2EE and .NET. The development of component technologies. Manage software development.	5	ON5
36	Machine-oriented programming	Students acquire basic knowledge of the basic concepts of machine-oriented programming, as well as the application of modern programming in Assembly. Organization of programs. Assembly programming. Basics of programming microcontrollers.	5	ON5
37	Methodology of object-oriented programming C #	Features of object-oriented programming in Java; objects and classes; inheritance, polymorphism and encapsulation. Representation as a set of objects with similar properties and a set of actions that can be done with them.	5	ON5
38	Optimization methods and operations research	Principles and features of problem solving in operations research. The main stages of operational research. Classification of tasks, models and optimization methods. Unconditional optimization methods. Methods for solving linear programming problems.	3	ON2
39	Основы веб-дизайна и программирования	Basics of creating software applications for the Web. Classification of software tools. The structure of programs for the Web. Applications running on the client and server. User interface development, interactive interface, navigation. Syntax of markup languages and scripting languages (HTLM, XML,	5	ON5

		JS, VBS, PERL, PHP).		
40	Basics of computational mathematics	Mathematical models of processes and phenomena in various fields of science and technology are one of the main ways of obtaining new knowledge and technological solutions. To carry out modeling, a student, regardless of his specialty, must know a certain minimum set of algorithms of computational mathematics, and also get into the ways of their software implementation on a personal computer.	5	ON2
41	Knowledge representation in information systems	Theoretical approaches and instrumental tools for designing, developing and debugging intelligent information systems (IMS), the stages of their development and examples of implementation are considered.	5	ON7
42	Java programming	Mastering and understanding the basic properties, tools and utilities of the Java platform, to teach students to develop applications for a wide range of tasks, to provide the basis for further study of Java technologies. Features of object-oriented programming in Java, objects and classes, inheritance, polymorphism. Representation as a set of objects with similar properties and a set of actions that can be done with them.	5	ON5
43	Database design	Basic concepts of database systems, architecture of relational database management systems; architecture database design; concepts of the relational model, elements of the standard relational language SQL; ideas about database administration; create a real relational database.	5	ON8
44	Designing user interfaces	Obtaining general information about the subject, technical and software tools for implementing competences in the field of user interface development using modern software (including those associated with the use of standard software packages) necessary for a graduate who has mastered the undergraduate program to solve various practical, scientific problems - research and teaching activities.	5	ON7
45	System programming	As a result of studying the “System Programming” discipline, students will acquire fundamental knowledge about the main theoretical and practical aspects of system programming at the program development level, which will enable them to obtain modern programs with a complex logical structure at the lowest cost. Get the skills to develop system applications.	5	ON5
46	Artificial intelligence system	We consider the classification of tasks of artificial intelligence, the basic methods of searching in the state space and in the space of the partition of tasks. The main methods of finding a solution, i.e. intelligence output strategies. The features of designing expert systems that are the result of the development of the theory and practice of AI are discussed.	5	ON7
47	Oracle DBMS	Basic concepts of corporate and distributed databases, the basics of OLAP, distributed database architecture, client / server architecture; understanding of the architecture and software environment of Oracle, elements of the standard SQL relational language for Oracle; elements of the development of data warehouses, obtaining programming skills in a procedural block-structured language PL / SQL.	5	ON8
48	The theory of decision-making	Simulation, management of IT-projects, software ERP-systems. Basic concepts of decision making. Modern approaches to building decision support systems (DSS), principles of visualization of the decision-making process (PR). Methods of achieving the goal.	3	ON2
49	Object-oriented programming technologies C#	Basics of programming in the selected development environment. Issues of creating applications in the selected development environment, as well as the basics of developing applications that work with databases. Solving the problem of program complexity. Representation in the form of a set of	5	ON5

		objects.		
50	Software systems design technologies	Application development tools, including Web applications using the Java language. Microsoft .NET initiative. Compatibility, reliability, and component reuse issues. NET Framework. Common Language Runtime CLR. Class Library. NET Framework. Implementing the capabilities of XSL, XPath, and other means of working with the XML data representation language using PHP, C # programming languages.	5	ON5
51	Web-programming technologies	Basics of creating software applications for the Web. Classification of software tools. The structure of programs for the Web. Applications running on the client and server. User interface development, interactive interface, navigation. Syntax of markup languages and scripting languages (HTLM, XML, JS, VBS, PERL, PHP).	5	ON5
52	Numerical methods	Approximate solution of algebraic and transcendental equations, systems of linear algebraic equations; interpolation of functions; numerical integration. Ordinary differential equations and numerical solution of partial differential equations.	5	ON2
Cycle of profile disciplines University component / Component of choice				
53	Simulation modeling	Study of the basics of building artificial intelligence systems, functioning, life cycle, directions of development of artificial intelligence systems, development of students ' competencies in the design and use of modern intelligent systems in professional activities, study and master the principles of building expert systems, consider promising areas of development of artificial intelligence systems and decision-making.	5	ON2
54	Database theory	Theoretical bases of data modeling, principles of design and maintenance of database systems (DBMS), data access control and data protection from destruction. Give practical skills in designing conceptual models, implementing databases and working with them, as well as develop practical skills in applying this knowledge.	5	ON8
55	Programming technologies	Technology programming (TP). TP offers a new powerful way to develop complex software systems. Instead of considering a program as a set of sequentially executed instructions, a program in a TP is represented as a set of objects with similar properties and a set of actions that can be performed with them.	7	ON5
56	Development of Mobile application technologies	The study of the basic device of popular mobile platforms and the opportunities offered by this platform for the development of mobile systems based on emulators, obtaining practical skills in creating user interfaces, services, as well as the use of signaling, hardware sensors and standard information stores of popular mobile platforms.	5	ON4
57	Analysis of geospatial data	Basic concepts in geographic information systems, GIS structure as an integrated system, Functional capabilities of modern GIS, Place of GIS among other automated systems, GIS toolkits, purposes and capabilities, Main GIS packages currently used and their characteristics.	5	ON8
58	Security of computer networks based on CISCO	Description of threats, services and security mechanisms of computer networks and systems, installation, methods of password reset and recovery on Cisco routers. Methods and means of data protection in computer networks. Cryptosystems. Access control in computer networks. Methods and means of protection while working in the Internet, configuration and verification of standard and extended ACL – lists, configuration and check of menu channel restrictions.	5	ON5
59	Internet-entrepreneurship	Technology business and Internet entrepreneurship, sources of ideas for a startup, verification of your	5	ON7

		idea, concept, creation of a startup team, distribution of roles in the team, business model, value proposition, market analysis, market potential assessment, competitor analysis, segmentation and target audience, from idea to product, startup Finance, monetization models, startup metrics and product Economics, marketing communications, attracting first users, startup advertising, investments.		
60	Information security and information protection	To acquaint students with the basic methods of determining and ensuring the reliability and quality indicators of automated systems. The concept of national security, types of security. The role and place of the information security system in the national security system of Kazakhstan. Symmetric and asymmetric encryption systems. Information threats. Countering information threats.	5	ON6
61	Computer security	To acquaint students with the basic methods for determining and ensuring the reliability and quality indicators of automated systems, which include information systems, familiarization with the main provisions of this theory, the concepts of evaluating and calculating the reliability of computers and systems. The concept of national security, types of security. The role and place of the information security system in the national security system of Kazakhstan.	5	ON6
62	IT-project management	Project and project activities, project cost and cost effectiveness, risks, project management, project management information systems, project management in the organization, it project management features, flexible methods, it in corporate projects, project monitoring and reporting.	5	ON7
63	Basics of geoinformation technologies	Introduction to geographic information systems. Data in GIS. Spatial data analysis, attribute table analysis. Methodology for creating GIS. GIS interface: structure and functions. Exploring spatial data formats. Data display in GIS.	5	ON8
64	Programming in PHP	The client-server technology is considered as the main area of application of the PHP language. After that, a number of application aspects will be considered: working with the file system, database, strings, sessions, DOM XML - all this will allow to consider the key tasks of practical use of the language.	5	ON5
65	Design of geographic information systems	Basic concepts in geographic information systems, the Structure of GIS as an integrated system, the Functionality of modern GIS, the Place of GIS among other automated systems, GIS tools, purpose and capabilities, the Main GIS packages currently used and their characteristics.	5	ON8
66	Development of graphic applications	Virtual computer for programming three-dimensional games. Three-dimensional mathematics and transformations. Creating a math library. Visualization of three-dimensional frame objects. Basics of three-dimensional visualization. Fundamentals of modeling lighting and surfaces tel. Interpolation shading methods and affine mapping. Secrets of three-dimensional visualization. Methods of complex texturing. Algorithms for partitioning space and the definition of visibility.	5	ON4
67	Computer game development	Basics of programming three-dimensional games. A short course on Windows and DirectX. Virtual computer for programming three-dimensional games. Three-dimensional mathematics and transformations. The tangled world of mathematics. The creation of a mathematical library. Introduction to three-dimensional graphics. Visualization of three-dimensional frame objects. Basics of three-dimensional visualization. The basics of modeling, lighting and surfaces of bodies. Interpolation shading methods and affine mapping. Secrets of three-dimensional visualization. Methods of complex texturing. Statement of the problem space and determine the visibility.	5	ON4
68	Distributed systems and cloud computing	Basics of programming three-dimensional games. A short course on Windows and DirectX. Virtual computer for programming three-dimensional games. Three-dimensional mathematics and	5	ON8

		transformations. The tangled world of mathematics. The creation of a mathematical library. Introduction to three-dimensional graphics. Visualization of three-dimensional frame objects. Basics of three-dimensional visualization. The basics of modeling, lighting and surfaces of bodies. Interpolation shading methods and affine mapping. Secrets of three-dimensional visualization. Methods of complex texturing. Statement of the problem space and determine the visibility.		
69	Server programming web applications	Server application. Cgi Protocol. Cgi script. The stages of interaction of the CGI script to the web server. Compiled and interpreted server-side scripting languages. Scripting languages: C/C++, Java, Ruby, Python, ASP. ISAPI extensions and filters. Scripting languages: Perl and PHP. Content management systems (CMS/CMF). Syndication and aggregation of web content. RSS feeds and RSS aggregators. RSS format. Atom. Web portal. Classification of portals: horizontal, vertical, corporate. Portlets, portlet standards, WSRP. AJAX. Microsoft AJAX Library. JSON data structures. Development of mobile web applications. WML.	5	ON5
70	3D modeling technologies and augmented reality	Features and differences of raster, vector and fractal graphics; color models used in computer graphics; types of graphic files; mathematical and algorithmic foundations of computer graphics: algorithms of raster graphics; representation of spatial forms; affine transformations of coordinate systems and objects; image input and visualization tools; basic raster algorithms of computer graphics.	5	ON4
71	IT-project management	The relationship of project management methodology with other management disciplines, the structuring of the project, models used for structuring of the project, major work on the project justification, development of project plan, organizational structure, responsibility matrix, project risk management, project monitoring and reporting.	5	ON7
72	Undergraduate practice	During the pre-diploma internship, students will master the skills of drawing up a work plan for individual sections of the graduation project, extract useful scientific and technical information from electronic libraries, review journals, etc., analytically approach the solution of the problems posed, present their own scientific results in the form of strictly substantiated statements , issue the results in the form of reports, articles, etc.	8	ON1, ON2, ON3,ON4, ON5, ON6, ON7, ON8