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

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«14» 04 2020 г.

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«14» 04 2020 г.

MODULAR EDUCATIONAL PROGRAM
DIRECTION 6B06102 – COMPUTER ENGINEERING AND SOFTWARE
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 Engineering and Technology*
Qualification level in accordance with the National Qualifications Framework: Level 6.

Almaty 2020

Training trajectories (specialty):
GIS technology;
Internet technologies;
Database;
Multimedia technology.

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 Amanbaev A.A., Ph.D., associate professor, Aitkazina A.A.

In the development of the educational program participated: Amanbaev 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 12/04/2020).

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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	6B06100020
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	6B06103 – Computer engineering and software
6	Type of EP	Current EP
7	Purpose of EP	Training of qualified specialists in the field of development of hardware and software for accelerated innovative development of the economy of the Republic of Kazakhstan
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. Know socio-humanitarian, historical, environmental, economic sciences, and be able to apply in professional activities. ON-2. Know the fundamentals of physical and mathematical sciences, mathematical and computer modeling, be able to apply this knowledge in solving engineering problems ON-3. To know the basics of operating systems, to be able to draw up programs for solving engineering problems, apply innovative ICTs, and develop system software. ON-4. Know the methods of developing databases and database protection systems, be able to develop databases, expert systems, artificial intelligence systems. ON-5. Know the basics of designing computer networks, be able to design computer networks and network protection systems, configure network equipment. ON-6. Know the methods of developing web applications, graphic applications, be able to design and develop web applications, information security systems in web applications ON-7. Know the basics of electronics, circuitry, be able to design electronic circuits and electronic devices, program electronic devices ON-8. Know the methods of developing mobile applications, games, computer graphics, be able to develop software applications for mobile devices. (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 “6B06103 - Computer engineering and software”
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	field of science and technology, which includes a combination of technologies, means, methods and methods of human activity, allowing for the exchange of information at a distance using technical means
22	Types of professional activity	production and technological; service and operational; organizational and management; assembly and commissioning; settlement and design; experimental research
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 6B06103- Computing equipment and software are either mandatory or variable with the required disciplines of the university component. For example, in the module “MVT-06 -“ Computer Modeling, Information and Communication and Web Technologies ”, the student can choose the discipline“ Web-technologies ”or“ Development of client-side web applications ”and thus master the competencies in a professionally oriented discipline, in the module “MVT-07 -“ Programming Technologies ”, the student can choose the discipline“ Modern Technologies for Developing Software Applications ”or“ Component Approach in Programming ”, and thus master the competencies in the discipline oriented in the development of software applications or master component technologies in programming. Special competencies inherent in the chosen trajectory (specialization) are fixed by studying the modules MVT12-1 - MVT12-2 of which the student chooses only one in accordance with the chosen trajectory (specialization).

The consolidation of special competencies, the ability to work in a team, in production, and independently solve tasks is facilitated by the development of the “MVT-11 Database and Artificial Intelligence” module.

4. Path selection method

Until the three 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 5th semester. From the 5th 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 educational program involves two learning paths: computer engineering, software engineering.

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 variable component. After studying the disciplines of the first and second semester, students will learn 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 cycles of general and basic disciplines continues. The share of the variable part in the second year is significant. In the second year, the beginning of the formation of the future profession is beginning, a significant proportion of disciplines is devoted to the theoretical foundations of computer technology and software. The choice of disciplines of the variable component does not affect the choice of the direction of preparation of the educational program, but forms the basic knowledge of computer technology and software with some features.

Thus, after choosing the disciplines of the third and fourth semester, students will learn 30 credits in the third semester and 30 credits in the fourth semester. In the fourth semester, four credits of Production Practice 1 must be mastered.

In the third year, the study of the disciplines of the cycle of basic disciplines continues, but a rather large block of core disciplines appears, both of the mandatory and the variational component. The proportion of the variable part in the third year is significant. Starting from the second year, the beginning of the formation of the future profession begins in the modules MVT-06-MVT-10, various disciplines and disciplines of the university component appear that are inherent in a specific direction of training of a future specialist, from these disciplines it is necessary to choose the discipline laying the foundation for specialization. After choosing the disciplines of the fifth and sixth semester, students will learn 30 credits in the fifth semester and 30 credits in the sixth semester. In the sixth semester, five Manufacturing Practice credits must be mastered.

In the fourth year, the study of the cycles of basic and major disciplines of the variative and university component continues. In the fifth semester, the study of the disciplines of a specific area of training for a future specialist begins (modules MVT12-1 Computer Engineering and MVT12-2 Software Engineering). The study of these modules is mandatory when choosing 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 the program.

Thus, after choosing the disciplines of the seventh semester, students will gain 30 credits. In the eighth semester, in addition to studying a number of disciplines, undergraduate practice and final certification must be mastered, a total of 30 credits.

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

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 "translation" of knowledge) 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 for innovative and high-tech IT industries.

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				
Mandatory component				
1	Modern history of Kazakhstan (in Kazakh language)	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	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
3	Module social-floor characters (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.	5	ON1
4	Module social-floor characters (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
5	Physical Education	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, 2, 3, 2	ON1
6	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
7	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
8	Kazakh (Russian) language1	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

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
9	Kazakh (Russian) language2	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
10	Information and communication technologies (in English)	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	ON3
		Total mandatory component of GE	**51**	
University component				
11	Economy, enterprise and industry management	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
12	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
13	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
		Total university component of GE	**5**	
The cycle of basic disciplines				
University component				
1	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

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
2	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
3	Mathematics 1	As a result of studying the discipline "Mathematics 1", students will study the fundamental sections of higher mathematics: elements of linear algebra and analytical geometry: determinants, matrices, systems of linear equations, vectors, equations of a line and a plane, curves of second order; differential and integral calculus of functions of one variable: limit of a function, continuity, derivative of a function, antiderivative, a definite integral, and complex numbers.	5	ON2
4	Mathematics 2	As a result of studying the discipline "Mathematics 2", students will study the sections of higher mathematics: differential and integral calculus of functions of several variables: partial derivatives, the total differential and its connection with 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, Fourier series.	5	ON2
5	Physics	As a result of studying the discipline "Physics", students will learn the theoretical foundations of classical mechanics, the elements of the special (private) theory of relativity, the foundations of molecular physics and thermodynamics, electrostatics, direct electric current and electromagnetism, mechanical vibrations and waves.	5	ON2
6	Educational practice. Computer Graphics Basics	As a result of studying the discipline, students will master the methods of computer geometry, raster and vector graphics, will acquire skills in working with graphic libraries and in modern graphic packages and systems, such as Photoshop, CorelDraw, etc.	3	ON3, ON4, ON7, ON8
7	Basics of Algorithmization and Programming	As a result of studying the discipline "Algorithms, Data Structures and Programming", students will receive competence in the basics of algorithmic tasks, methods of program development, dynamic data structures, software design methods, programming style, debugging methods and testing programs.	5	ON3
8	Software Development Tools	As a result of studying the discipline, students will learn the classification of tools, methods and tools, design methods and the life cycle of programs, a unified modeling language (UML), tools to support the software development life cycle, building the program interface.	3	ON3, ON4, ON5, ON6
9	Operating Systems	As a result of studying the discipline students will master the skills of installing and configuring network hardware in modern operating systems, ensuring the assignment of access rights, password protection, and package management in various operating systems	4	ON1, ON2, ON3, ON4, ON6, ON7

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
10	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	ON1, ON4, ON6, ON7
11	Electronics	As a result of studying the discipline, students will learn the fundamentals of semiconductor physics, semiconductor electrical conductivity, pn junction theory, main and minor charge carriers, free carrier movement, methods for controlling conductivity in semiconductors, diode characteristics, design and application features, zener diodes, transistors, device and principle actions of a bipolar transistor and a field-effect transistor, Volt-ampere characteristics of transistors., thyristor, principle of operation, design, types and methods of connection.	5	ON1, ON4, ON6
12	Internship 1,2	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, and draw up the results obtained in the form of reports and software documentation.	5, 5	ON1,ON2, ON3,
		Total university component of BD	**56**	
Component of choice				
	Discipline of choice 1 (choose 1 of 2)		5	
13	Theory of Probability and Mathematical Statistics	As a result of studying the discipline "Theory of Probability and Mathematical Statistics," students will master the competences in the field of fundamental knowledge of probability theory and mathematical statistics; will be able to apply the theoretical knowledge to solve practical problems.		ON1, ON3, ON5
14	Discrete Mathematics in Programming	As a result of studying the discipline “Discrete Mathematics in Programming”, students will master the concepts of set theory and mathematical logic; acquire skills in applying modern computer programs using classical methods for solving applied problems, finding optimal methods for solving practical problems, and also using methods of discrete mathematics in solving professional issues.		ON1, ON3, ON5
	Discipline of choice 2 (choose 1 of 2)		5	
15	Web technologies	As a result of studying the discipline "Web technologies", students will learn the principles of organization and functioning of Internet technologies. They will master the competences of creating software applications based on modern Web-technologies, using computer programs in research and development related to modern Internet technologies, creating web-sites using client-side and server-side programming tools.		ON1, ON5
16	Development of client web applications	creating Web-based applications using modern Web-technologies, applying modern software tools for solving applied problems using the global Internet, the technology of designing the structure of a web-site as an information system.		ON1, ON5
	Discipline of choice 3 (choose 1 of 2)		5	

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
17	3D technologies	Discipline involves the study of the following topics: Features and differences raster, vector and fractal graphics; color models used in computer graphics; types of graphic files; mathematical and algorithmic basics of computer graphics: raster graphics algorithms; representation of spatial forms; affine transformations of coordinate systems and objects; image input and visualization tools; basic raster algorithms for computer graphics.		ON2, ON6, ON7
18	Development of graphic Application	The discipline "Development of Graphic Applications" involves the study of modern methods of modeling phenomena and processes, the subject of study is a special class of models - 3d models (three-dimensional models), consideration of the possibilities of the closest modeling of real objects and phenomena.		ON1, ON4, ON7
	Discipline of choice 4 (choose 1 of 2)		6	
19	Programming technology	Discipline involves the study of the following topics: Basic concepts of programming technology, methods and approaches. Classic technological processes. Standard technological processes. The main stages of technological approaches. Basic technological approaches. Collective development technologies. Quality software. The concept of syntactic analysis. System approach to programming technology. A detailed study of the theory of algorithms and programming methods.		ON2, ON4, ON6, ON7
20	Languages and programming technologies	As a result of studying the discipline “Languages and Technologies of Programming”, students will gain competence in organizing data structures, developing structural diagrams of algorithms for solving set tasks, knowing how to choose a programming language, using it as a means of solving a set problem, debugging and testing developed programs, using quality software documentation.		ON2, ON4, ON6, ON8
	Discipline of choice 5 (choose 1 of 2)		6	
21	Object oriented programming	As a result of studying the object-oriented programming discipline, students will receive the competence of the theoretical principles of object-oriented programming, the use of modern methods and tools for developing algorithms and programs, the ability to apply modern object-oriented programming technologies in solving complex applied problems in creating information systems.		ON1, ON2, ON4
22	Java programming	As a result of studying the “Java Programming” discipline, students will master the competencies of working with elements of Java applications; determine the result of the use of operators; data type conversions when performing assignment operations, concatenating strings, calculating arithmetic expressions, and calling a method; competent writing code programs; exception handling; practical application of the basic concepts of object-oriented programming.		ON3, ON4, ON6, ON7
	Discipline of choice 6 (choose 1 of 2)		5	
23	Modern technologies for developing software applications	As a result of the discipline, students will study: the basics of the interaction of the processes of a distributed application, the model of the interaction of open systems. Client-server architecture, socket and RPC interfaces, network utilities, distributed application process diagrams, communication channel basics. The organization of interaction between the client and the server.		ON4, ON5, ON6

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
24	Component programming approach	As a result of the discipline, students will study: Problems of developing complex software systems, a unified development process and extreme programming, analysis of the subject area and software requirements, software quality and control methods, software architecture., Design samples, principles for creating a convenient user interface, component technologies and distributed software development		ON4, ON5, ON6
	Discipline of choice 7 (choose 1 of 2)		3	
25	Fundamentals of IP-telephony and streaming technologies	As a result of studying the discipline, students will receive basic knowledge about the principles of implementing IP-telephony networks, streaming and processing technologies; high-quality video communications organizing methods; knowledge and effective use of the capabilities of modern streaming technologies for the creation and distribution of audio-video content, including in real time.		ON1, ON2, ON4
26	Multimedia technology	The discipline is intended to consolidate the knowledge and skills of the effective use of various modern multimedia technologies for the collection, design, creation, processing, analysis, layout, testing of standard file formats for text, graphic, audio and video information for solving professional tasks.		ON1, ON2, ON4
	Discipline of choice 8 (choose 1 of 2)		5	
27	Computer networks	As a result of studying the “Computer Networks” discipline, students will master the competencies in the theoretical foundations of the construction and operation of computer networks; in understanding the nature and development trends of technologies of local and global computer networks; creation of corporate network architecture, network management companies Cisco, Juniper, Huawei, network administration, monitoring and network security system development.		ON2, ON5, ON6, ON7
28	Basics of building a network infrastructure	As a result of studying the discipline, students will master the skills of creating corporate network architecture; network management companies Cisco, Juniper, Huawei; administration, monitoring and network security, working with Cisco equipment; static, dynamic IP addressing settings; destination routing static and dynamic IP addressing; applying VLAN technology in the switch; network address translation.		ON2, ON5, ON6, ON7
	Дисц Discipline of choice 9 (choose 1 of 2)		3	
29	Basics of cryptographic protection of information	Discipline involves familiarizing students with organizational, technical, algorithmic and other methods and means of protecting computer information, with legislation and standards in this area, with modern cryptosystems, and writing students with programs using cryptographic methods.		ON2, ON5, ON7
30	Information Security and Information Protected	As a result of studying the discipline, they will gain skills and competences to use, implement and implement known methods and means of protecting information in systems and networks, the ability to recognize threats and channels of information leakage, applying methods and means of protecting information to ensure the security of systems and networks.		ON2, ON5, ON6, ON7
	Discipline of choice 10 (choose 1 of 2)		5	

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
31	Database technology	Discipline involves the study of the following topics by students: Basic concepts of a database system, 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.		ON4, ON6, ON7, ON8
32	Server databases	Discipline involves the study of the following topics by students: The concepts of the server model, functions of a standard relational language, ideas about administration and creation of a server database, work in a network database, basic concepts of a server database, architecture of relational database management systems; client / server architecture		ON4, ON5, ON6
	Discipline of choice 11 (choose 1 of 2)		5	
33	Modern DBMS in corporate systems	Discipline involves the study by students of the following topics: Structure, evolution, classification of KRSBD. Administrative concepts KRSBD. An overview of the basic concepts of corporate governance supported. modern corporate systems. The concept of CPR is capacity planning. The concept of MPR is material requirements planning. The concept of EPR - enterprise resource planning, etc.		ON4, ON5, ON6
34	Designing databases based on modern DBMS	Discipline involves the study by students of the following topics: 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.		ON4, ON5, ON6
	Discipline of choice 12 (choose 1 of 2)		3	
35	The basics of building intelligent information systems	Formation of knowledge about various Internet technologies that allow you to rationally organize the work process in any area, manage various work processes remotely and carry out other work with minimal labor costs. At the end of the course, students will have a knowledge and practical ability to find information, process and transmit any kind of data in a wide variety of formats.		ON4, ON5, ON6
36	Basics of On-line technologies	Formation of knowledge about various On-line technologies used for communication at a distance in various areas of production, government, educational and personal activities. Upon completion of the course, students will be able to independently configure and use various Internet applications in various fields.		ON4, ON5, ON6
		Total component of choice of BD	**56**	
Cycle of profile disciplines				
University component				

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
1	Server web programming	Discipline involves the study of the following topics by students: Server applications. CGI protocol. CGI scripts. Stages of interaction of a CGI script with a web server. Compiled and interpreted server script development languages. Scripting languages: C / C ++, Java, Ruby, Python, ASP. ISAPI extensions and filters. Scripting languages: Perl and PHP.	7	ON4, ON5, ON6
2	Digital circuit design	Discipline involves the study by students of the following topics: The principles of building typical combinational and sequential devices. Ways of organizing memory devices and features of their functioning. Typical microprocessor architecture and microprocessor system programming techniques. Ways to organize the work of typical peripherals.	5	ON4, ON5, ON6
3	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	ON4, ON5, ON6
		Total university component of PD	**20**	
Cycle of profile disciplines				
Component of choice				
	Discipline of choice 1 (choose 1 of 2)		5	
4	Analysis and design of software applications	Discipline involves students studying the following topics: The use of object-oriented programming. MVC: The Microsoft .NET Initiative. Component compatibility, reliability, and reuse issues. NET Framework. Common language runtime CLR. .NET Framework Class Library Implementation of XSL, XPath and other tools for working with the XML data representation language using the PHP programming languages, C #. Application development tools, including Web applications using the Java language.		ON3, ON4, ON5
5	Software Design Technologies	Discipline involves the study of the following topics by students: Application development tools, including Web-based applications using the Java language. The use of object-oriented programming. MVC. 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.		ON3, ON4, ON5
	Discipline of choice 2 (choose 1 of 2)		5	
6	Software Development Based on IOS	Discipline involves the study of the following topics by students: Designing applications and developing interfaces for mobile devices based on IOS, including the principles of human interaction with a mobile device, the basics of testing and debugging applications on the device, recommendations for transferring previously developed applications to the device, marketing training and publishing applications .		ON1, ON3, ON4, ON5, ON6, ON7

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
7	Development of software applications based on Android	Discipline involves the study of the following topics by students: Basic principles for developing applications for Android, Basic principles and tools for developing and publishing applications for mobile devices running on the Android platform. The structure of applications based on new design, and the use of software tools development environments. Technologies for creating interface applications, principles of organization and use of databases		ON1, ON3, ON4, ON5, ON6, ON7
	Discipline of choice 3 (choose 1 of 2)		5	
8	Cloud computing and server administration system	Discipline involves the study by students of the following topics: Construction and architecture of modern operating systems and environments (including distributed), ensuring the organization of computational processes in corporate information systems for economic, managerial, industrial, scientific and other purposes; Creation (tuning) of the computing environment for the implementation of business processes in corporate networks (intranets) of enterprises. Discipline involves the study by students of the following topics: The development and use of cloud computing technologies; Basic models for the provision of cloud computing services; Review of leading vendors' decisions - Microsoft, Amazon, Google; Analysis of the main advantages and disadvantages of cloud computing models and solutions proposed on their basis.		ON1, ON6, ON7
9	Administering High Performance Linux-Based Computing Systems	Discipline involves the study of the following topics by students: Features of work in multi-user environments. Administration in the Unix environment, in networks with the Linux operating system, Oracle DBMS. The exchange of information between network nodes connected data lines. The main components used in the creation of systems.		ON1, ON6, ON7
	Discipline of choice 4 (choose 1 of 2)		5	
10	Business Application Development Technologies	Discipline involves the study of the following topics by students: the basics of designing and developing business applications, testing developed applications, developing additional modules in designed applications, developing an application protection system in computer systems, principles, methods and means of implementing applications.		ON1, ON6
11	Internet entrepreneurship	Discipline involves the study of the following topics by students: Technology business and Internet entrepreneurship, sources of ideas for a startup, testing their ideas, concept, creating a startup team, assigning roles to a team, business model, value proposition, market analysis, market potential assessment, competitor analysis , segmentation and target audience, from idea to product, start-up finances, monetization models, start-up metrics and product economics, marketing communications, first-party involvement, start-up advertising Investments		ON1, ON6
	Discipline of choice 5 (choose 1 of 2)		5	

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
12	Development of expert systems	As a result of studying the discipline they will master the competences of formalizing knowledge representation, analyzing the results of modeling; application of methods and models of expert systems; evaluating the effectiveness and choosing the type of models and methods of knowledge representation when creating expert systems; design and development of expert systems in various fields of knowledge.		ON4, ON6, ON7, ON8
13	Development of artificial intelligence systems	As a result of studying the discipline they will master the competences of conducting tactics of identifying expert knowledge; development of formalization of knowledge representation of an expert; methods and models of expert and intelligent systems; basic technologies for creating expert systems; master the competence of designing and developing artificial intelligence systems in various fields of knowledge.		ON3, ON4, ON5, ON6, ON8, ON9
		Total component of choice of PD	**25**	
Component of choice				
Training trajectories (specialty):computer engineering.				
14	Basics of programming robotics devices	Discipline involves the study of the following topics by students: Kinematics of robots: position analysis, differential movements and speeds. Trajectory planning. Drives, sensors and simple sensor processing algorithms. Visual servo drive. Architecture of programming and control of the robot. Selected topics on mobile robotics (localization, cartography, navigation and motion planning).	5	ON2, ON4, ON6, ON7
15	CISCO-based computer network security	As a result of studying the discipline, students will master the skills to perform basic configuration and diagnostics of the state of local computer networks; use of modern software for network diagnostics and monitoring; operate modern network equipment, solve maintenance, network diagnostics tasks, plan strategies for modernizing and expanding local networks	5	ON2, ON4, ON6, ON7
16	IP telephony systems	As a result of studying the discipline "IP-telephony systems", students will learn the competence of using IP telephony and its features, setting up wireless networks, mastering the principles of upgrading existing systems using advanced technologies and skills to configure Cisco gateways and inter-cluster trunks, create a call routing plan in CiscoCallManager for calls to remote clusters.	5	ON2, ON4, ON6, ON7
		Total component of choice of PD	**15**	
Training trajectories (specialty): software engineering				
17	Arduino Microcontroller Programming	As a result of studying the discipline, they will acquire the skills of describing a common debugging architecture for embedded systems; studying the provided source codes and online resources to expand knowledge about the capabilities of the Arduino microcontroller; master the competence of designing circuits, connecting them to an Arduino microcontroller, and running Arduino programs to manage electrical circuits.	5	ON2, ON4, ON6, ON7
18	Network programming	Discipline involves the study of the following topics by students: Principles and foundations for the joint use of object-oriented programming and network technologies for creating network applications and the necessary development tools using the Java language. Application of network application development methods using sockets, RPC, RPM and Corba using the Java language. Application areas of network applications.	5	ON2, ON4, ON6, ON7
19	Gaming Development	Discipline involves the study by students of the following topics: Fundamentals of programming three-	5	ON3, ON4, ON5,

№	Name of the discipline	Discipline Summary (30-50 words)	Amount of credits	Formed competencies (codes)
	Technologies	dimensional games. Virtual computer for programming three-dimensional games. Three-dimensional mathematics and transformations. Secrets of three-dimensional visualization. Methods of complex texturing. Algorithms for partitioning space and the definition of visibility. Lighting and shadows. Animation, physical modeling and optimization. Animation, movement and detection. Optimization technologies.		ON6
		Total component of choice of PD	**15**	