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"
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Innovative Companies SEZ "PIT"
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"16" 04 2019

"Approved"
AUPET Rector
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"16" 04 2019

MODULAR EDUCATIONAL PROGRAM
7M06103 COMPUTER ENGINEERING AND SOFTWARE

(SCIENTIFIC AND PEDAGOGICAL MAGISTRACY)

POSTGRADUATE EDUCATION

Direction of study (according to the classifier dated 10/13/2018):
7M061 Information and Communication Technology
Educational Programs Group: M094 Information Technology

Duration of study 2 years
Awarded academic degree: Master of Engineering
Qualification level in accordance with the National Qualifications Framework: Level 7.

Almaty 2019 r.

The educational program 7M06103 is developed on the basis of the State Compulsory Standard for Higher Education (Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 604, Appendix 8), National Qualifications Framework (approved by the protocol of March 16, 2016 by the Republican Tripartite Commission for Social Partnership and regulation of social and labor relations), Sectoral Qualifications Framework "Computer Engineering and Software" and projects of professional standards.

The modular educational program was developed at the IT Engineering Department.

Heads of the educational program Kartbayev T.S., Togzhanova K.O.

The program was reviewed and approved at a meeting of the IT Engineering Department, protocol No. 8 dated March 19, 2019.

Head of IT Engineering Department _____ Kartbayev T.S.

The program was approved at a meeting of the educational-methodical commission of the Institute of Control Systems and Information Technology. Protocol No. 4 dated March 26, 2019.

Director of ICSIT _____ Tabultayev S.S.

The EP was reviewed and approved by the Scientific and Methodological Council of AUPET (protocol No. 5 dated 03/29/2019).

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Educational program passport

№	Field name	Notes
1	Registration number	7M06100121
2	Code and classification of the field of education	7M061 Information and Communications Technology
3	Code and classification of training areas	7M061 Information and Communications Technology
4	Group of educational programs	M094 Information Technology
5	Name of educational program	7M06103 Computer engineering and software (scientific and pedagogical magistracy)
6	Type of EP	a) Current EP;
7	Purpose of EP	The purpose of the master's educational program is to prepare highly qualified researchers, competitive specialists in the field of developing hardware and software and computer science for the accelerated innovative development of the economy of the Republic of Kazakhstan.
8	ISCE level	7
9	NQF level	7
10	SQF level	7
11	Distinctive features of EP	-
	Partner university (AEP)	-
12	The list of competencies	Learning outcomes and correlation of the learning outcomes on the educational program with the formed competencies are presented in appendices 1 and 3
13	Learning outcomes	(LO-01). To put into practice the theory and methods of humanitarian, social, ethical and scientific-pedagogical in various types of professional activity. (LO-02) To conduct scientific research in a selected field and to process theoretical and experimental results using technical means and complexes; (LO-03) To study and apply the software and hardware methods of cryptographic protection in the development of software and to understand the regulatory framework; (LO-04) To apply methods of teaching disciplines in programming, to design, develop software for computer systems and complexes; (LO-05) To develop a system for collecting, storing, analyzing, managing data using BigData, DataMining, cloud and distributed computing technologies; (LO-06) To develop, document design and technological solutions, to manage the business process of developing a hardware-software complex; (LO-07) To apply models and methods of artificial intelligence, machine learning and neural networks in solving applied problems in various industries; (LO-08) To apply mathematical, instrumental decision-making methods, to evaluate the effectiveness of algorithms in solving complex optimization problems.

14	Form of learning	Full-time, distance
15	Language of learning	Russian, Kazakh
16	Credits	120
17	Awarded Academic Degree	Master of Science
18	Availability of an appendix to the license for the training	Unlimited State license for educational activities **АБ № 0137445 dated 08/04/2010**
19	Availability of accreditation of EP	yes
	Name of accreditation body	IKAQAE, IARA
	Accreditation Duration	2020, 2024.
20	Information about disciplines	Information about disciplines of UC/OC DD, PD are presented in Appendix 1
21	Professional activity	The sphere of professional activity of graduates is state and private enterprises and organizations that develop, implement and use computer technology and software in various fields, namely: engineering, metallurgy, transport, telecommunications, science and education, healthcare, agriculture, in the service sector, administrative management, economics, business, management of various technologies, that is, in almost all spheres of human activity.
22	Types of professional activity	Specialist for work in research universities, research and design institutes, universities, enterprises of energy profile is capable of performing the following professional activities: - design and development; - production and technological; - experimental research; - organizational and management; - operational.
23	Modular Curriculum	Given in appendix 2

1. The structure of the educational program of postgraduate education (scientific and pedagogical magistracy)

The list of disciplines of the university component and optional component is determined by the university on its own. This takes into account the needs of the labor market, the expectations of employers, the needs and interests of undergraduates. The university component of the basic disciplines cycle of all educational programs of the master's program in the scientific and pedagogical direction in accordance with the State Compulsory Standard of Education includes the disciplines “History and Philosophy of Science”, “Foreign Language (Professional)”, “Pedagogy of Higher Education”, “Management Psychology”.

Appendix 1
To the State Compulsory
Standard of Education

The structure of master’s educational program on the scientific and pedagogical direction

No.	The name of the cycles of disciplines and activities	Total labor input	
		in academic hours	in academic credits
1	*2*	*3*	*4*
1.	Theoretical training	1920	64
1.1.	Cycle of basic disciplines (BD)	1050	35
1)	University component (UC)	600	20
	including:		
	The history and philosophy of science		
	Foreign language (professional)		
	Pedagogy of Higher Education		
	Management Psychology		
	Teaching practice		
2)	Optional component (OC)	450	15
1.2.	Cycle of profile disciplines (PD)	1470	49
1)	University component (UC)		
2)	Optional component (OC)		
3)	Research practice		
2.	Research work	720	24
1)	Master's research work, including internships and master's dissertation work (NIRM)	720	24
3.	Additional types of education (ATE)		
4.	Final examination (FE)	360	12
1)	Preparation and defense of a master's dissertation work (PDMDW)	360	12
	TOTAL	3600	120

In magistracy of the scientific and pedagogical direction, the volume of the BD cycle is 29% of the total volume of the educational program of the magistracy or 35 academic credits. Among them, 57% or 20 academic credits are allocated to UC.

In magistracy of the scientific and pedagogical direction, the volume of the PD cycle is 41%, or 49 academic credits of the total volume of the educational program of the magistracy.

Modular educational program 7M06103 Computer engineering and software meets the requirements of the state compulsory standard of postgraduate education and the structure of the educational program of postgraduate education (scientific and pedagogical direction magistracy), contains all the necessary components, has a university and optional components. In the modular program, there are the minimum requirements for the number of credits for theoretical training -108 and 12 credits for final certification (10%). The dates and types of practices in the educational program are defined as: pedagogical - 3 semester (4 credits), research - 2 semester (4 credits), research - 4 semester (7 credits). The variable component is defined in the catalog of elective disciplines.

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 methodological basis of modular training are the principles, methodology and procedure for developing modular educational programs. The effectiveness of learning outcomes is achieved by observing an integrated approach, when the educational programs, as well as curricula, and academic 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 learning path and obtaining special professional competencies that increase competitiveness in the labor market.

4. Path selection method

As a result of the implementation of the chosen educational trajectory, the necessary competencies must be obtained. An individual educational path consists of a university (compulsory), variative, corrective and organizational parts. The compulsory part includes the basic modules for studying, which correspond to the structure of the educational program of postgraduate education. The variative part includes a set of modules and their components, which the undergraduate chooses to study depending on the areas of study that interests him. The compulsory and variative parts are aimed at determining the content of learning. Already in the first year of study, the undergraduate chooses the specialization of learning and in the variative part of the educational program selects a special training module, which is compulsory for study.

The corrective part involves assisting students in choosing the 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
1. Individual work of undergraduates 2. The choice of disciplines of the variative component 3. The choice of an additional profile of training, in the framework of academic exchange and scientific internships	Set of Doctoral and Postgraduate Programs	Working curriculum; Timetable of classes; Schedule of consultations of teachers of IWM; curriculum monitoring
	Departments, Advisors, Tutors	Individual undergraduate curriculum
	Teachers	EMDC, schedule of completion of tasks, list of recommended literature
	Undergraduates	Library, electronic publications, Internet, syllabuses

Table 4.2 presents the substantive component of IEP training. The substantive component specifies the variants for the formation of individual educational technology. Within the framework of the educational program, it is possible to implement academic mobility, receive additional education (an additional set of disciplines (credits) within the framework of the SCO University), and receive a second diploma at a partner university.

Table 4.2 Substantive component of IEP training

IEP variants	Providing asynchronous learning	Tools providing asynchrony
Individual competency set	Tutors, undergraduates	Individual undergraduate curriculum
	Departments, supervisors	A set of variative disciplines, an individual undergraduate work plan
	Set of Doctoral and Postgraduate Programs	Work curriculum
Concretization of the training profile (CGW, TW, research work)	Tutors, undergraduates	Individual undergraduate curriculum
	Departments, supervisors	Exemplary topics for TW, CGW topics, ERMW topics
Individual level of mastering disciplines (high, medium, low)	Undergraduates, supervisors	Regulations on the ball-rating system of task completion, schedule of assignments, experimental research work, practice
Professional adaptation to professional activities during the practice	Undergraduates, departments, supervisors, YD	Practice programs, agreements with enterprises on the bases of practices, the formation of individual tasks for practice
An expanded set of professional competencies (selection of an additional training profile)	Undergraduates, supervisors	Individual undergraduate work plan
	YD, Undergraduates, supervisors, AUES international department	Non-linear schedule, the main educational program of an additional learning profile, professional advanced training courses, internships, a list of disciplines (credits) within the framework of the SCO University, a list of credits within the framework of academic mobility

The undergraduate studies the cycles of basic and profile disciplines of the variative component in accordance with the chosen direction of training. Choosing variative disciplines, the direction of

work on the master's dissertation work and the advice of the supervisor are taken into account. In the fourth semester, preparations for final certification and research practice are being carried out, issues with concrete filling of the dissertation during the research practice are being solved. After choosing the disciplines, undergraduates will gain 30 credits in the first, second and third semester. The pedagogical and research practice, research work and final certification should be mastered.

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

The possibilities of the educational program are great, by the formation of additional modules in the cycle of profile disciplines in the variative part of the program there can be prepared specialists on a wide variety of specializations, keeping up with the times.

Table 4.3 A summary table reflecting the number of mastered credits in terms of modules of the educational program

Curriculum	Semester	The number of mastered modules	Number of disciplines		Number of credits KZ						Total in hours	ECTS	Amount	
			VC	OC	Theoretical training	Pedagogical practice	Internship	Research work	Final examination	Total			examination	Differential credit
1	1	4	5	3	29	0	0	1	0	30	900	30	8	1
	2	3	-	5	25	4	0	1	0	30	900	30	5	2
2	3	2	-	3	15	0	4	11	0	30	900	30	3	2
	4	3	-	-	0	0	7	11	12	30	900	30	КЭ	2
Total:			5	11	69	4	11	24	12	120	3600	120	16+КЭ	7

Appendix 1

Table П1.1 Information about the studied disciplines and formed competencies

№	Name of the discipline (D)	Brief description of the discipline (in 30-50 word)	Credits	Formed learning outcomes (codes)
The cycle of basic disciplines University component				
1	History and philosophy of science	In the result of studying the discipline undergraduates can apply methodological and methodical techniques and knowledge in research, teaching and educational work, analyze and comprehend the realities of modern theory and practice based on the history and philosophy of science.	3	LO -1
2	Foreign language (professional)	The discipline is aimed at the development of speech skills of oral and written communication, reading and translation of texts in the specialty, producing monological statements. As a result, they will be able to demonstrate knowledge of word-formation models, contextual meanings of polysemantic words, terms, lexical constructions, as well as grammar and syntax of technical language; skills of search, processing and selection of information from foreign scientific and technical literature.	5	LO -1
3	Psychology of management	To reveal the main methodological provisions of pedagogical science, its basic laws, principles within the processes of teaching and education in higher education, didactics, system, activity, technological and personality-oriented approaches as a methodology of pedagogy, as well as methods, problems and prospects of its development;	5	LO -1
4	Higher School Pedagogy	The development of undergraduates professional reflection in the field of psychology, the effectiveness of which depends on the scientific approach, psychological competence and skillful use of psychological resources. Thus, the need to develop psychological and pedagogical competence of specialists in the new conditions of social development determines the relevance of this course in the system of higher education. Stimulate the development of interest in practical psychological activity	3	LO -2
5	Teaching practice	The discipline is aimed at the development of speech skills of oral and written communication, reading and translation of texts in the specialty, producing monological statements. As a result, they will be able to demonstrate knowledge of word-formation models, contextual meanings of polysemantic words, terms, lexical constructions, as well as grammar and syntax of technical language; skills of search, processing and selection of information from foreign scientific and technical literature.	4	
The cycle of basic disciplines Optional component				
6	Artificial Neural Networks	Methods of teaching neural networks. natural classification networks. Application of ins to the Humanities Associative ins. Self-organizing networks or and linguistics. Fundamentals of parallel information processing. Architecture and design of neiromediatorov. Principles of development and construction of modern automated systems of scientific research, software tools used in this field, the trend of development and application of such systems.	5	LO -7
7	Machine learning	The purpose of this course is to learn the basics of machine learning theory, including discriminant, cluster and regression analysis, and to master the skills of practical solutions to data	5	LO -7

		mining problems. The course covers the main tasks of using case studies: classification, clustering, regression, and dimension reduction. We study methods for solving them, both classic and new, created over the past 10 years. The emphasis is on a deep understanding of the mathematical foundations, relationships, advantages and limitations of the methods under consideration. Individual theorems are given with proofs.		
8	Technologies and algorithms for high-performance and distributed computing	Use of technologies and algorithms of high-performance and distributed computing, methods of parallel multithreaded and distributed programming of high-speed computing. Features and principles of architecture of high-speed systems and networks; features of high-performance and distributed computing, the basic principles of construction of high-performance and distributed systems, programs and processes; features of distributed data processing.	5	LO -5
9	Cloud and parallel computing technologies	The purpose of the discipline is to study the principles and algorithms of parallel, cloud computing and practical use complex systems, modern methods of cloud and parallel computing to solve labor-intensive computing problems.	5	LO -5
10	Algorithms and their complexity	Development of undergraduates understanding of the principles and concepts on which the development of algorithms is based. Analysis of algorithms, construction of algorithms. Mathematical bases of the analysis of algorithms. Sorting through the pile. Quick sort. Sorting in linear time. Dynamic programming. Greedy algorithm. Parallel computation algorithms. NP – complete tasks.	5	LO -8
11	Mathematical and instrumental decision support methods	Development of methods and means of formalization of subject problems with the help of mathematical models, the ability to formalize the problem of decision-making under certainty, uncertainty, risk, stochastic decision-making problem, multi-criteria decision-making problem, the development of algorithms and methods for finding the optimal solution depending on the type of the problem.	5	LO -8
The cycle of profile disciplines University component / Optional component				
12	Design and analysis of web interfaces	Ознакомить студентов с принципами организации и функционирования службы WEB, обучение методам проектирования приложений для использования в среде Интернет, а также принципы организации и функционирования WEB приложений в Интернет. Технологии создания сайтов должны рассматриваться комплексно, т.к. за последние годы методы организации работы Интернет получили значительное развитие и приобрели определенную логическую завершенность.	5	LO-4
13	Web site design and development tools	To acquaint students with the principles of organization and functioning of the WEB service, training in methods of designing applications for use in the Internet environment, as well as the principles of organization and functioning of WEB applications on the Internet. Technologies of creation of sites should be considered comprehensively, because in recent years the methods of organization of the Internet have received significant development	3	LO -4

		and acquired a certain logical completeness.		
14	Software development using visual programming tools	Application of Web-technology in industrial facilities. Creation of information systems in telecommunications using Web-technologies, as well as the principles of organization and functioning of WEB applications on the Internet. Technologies of creation of sites should be considered comprehensively,because in recent years the methods of organization of the Internet have received significant development and acquired a certain logical completeness.	6	LO -4
15	Scalable Systems Development Technologies	As a result of studying the discipline undergraduates should know the ways of parallel processing of information; principles of system organization of computing facilities; on the current state of development of the armed forces and telecommunications; be able to choose the structure of the armed forces and the mode of its operation; apply methods to improve system performance and increase its reliability; choose the necessary set and structure of components of mathematical support	6	LO -4
16	Software development technologies for real-time systems	The main stages of development of information and control systems of real time (SRV). Principles of real-time systems. Providing the program. Modes of computer operation in real-time systems. Design and implementation of real time's. Methods of testing and verification of real-time systems.	5	LO -4
17	Designing information systems using modern DBMS	Scientific approach to the analysis and principles of DBMS, the basic principles of building systems focused on data analysis; modern data mining technologies; data models used to build storage; features of building systems based on data warehouses; basic principles of OLAP; purpose and application of data mining methods.	6	LO -5
18	Big Data Storage and Processing Technologies	Familiarization with the peculiarities of working with large unstructured and semi-structured data, technologies and languages of data manipulation, methods and tools of big data analysis, including the use of distributed systems and modern query languages, database configuration and organization, selection of DBMS to solve the application problem, the use of the database in IP projects	6	LO -5
18	Software Engineering Technologies	As a result of studying the discipline, undergraduates will be able to obtain systematic knowledge about the principles of object-oriented design, programming and testing of software systems, design templates of standard solutions and components of information processing systems; develop technical specifications for the designed automation object taking into account the results of research and development work	6	LO -4 LO -6
19	Analysis and design of business processes	In the result of studying the discipline, undergraduates will be able to perform a systematic analysis of the subject area to build conceptual schemes of the developed project; create models and diagrams according to the concept of MDA; apply in practice the basic templates of building a project in the modern design environment.	6	LO-4 LO -6

20	Modern cryptographic methods of information security	Modern cryptographic methods used to protect information in information systems, local and corporate networks. The main classes of symmetric cryptosystems. General information about block ciphers, stream ciphers, self-Synchronizing ciphers. Synchronous ciphers. Asymmetric encryption systems. Digital signatures based on asymmetric cryptosystems. CPU standards; hashing functions; cryptographic key management, information security in the ACS.	3	LO -3
21	Corporate Information System Security Management	Models and methods in information security management of corporate information systems. Conceptual apparatus in the field of information security, Methodological foundations of integrated information security, Analysis and management of information systems security. Evaluation of the effectiveness of measures to ensure is.	5	LO -3
22	Modern routing and switching systems in computer networks	Modern means of information transfer, network technologies, principles and technologies of network construction, General principles of construction and requirements for the design of modern networks; IPv6 addressing; the main methods and components used in the creation of a new generation of networks; basic technologies of cloud networks; high-speed technology of building support networks; modern methods of routing and switching to a network of computer networks.	6	LO -2
23	Design and protection of information and communication systems	Studying the functionality of integrated networks based on modern communication equipment, network technologies and protocols; studying the basics and principles of building modern network technologies, preparing them for the effective use of information technologies in future professional activities. Modern means of information transfer, network technologies, principles and technologies of building networks, creation of computer networks.	6	LO -2
24	Microprocessor systems design	Principles of organization of microprocessor systems on the basis of individual microprocessors and their fundamental functional units, produced in the form of a corresponding set of microprocessor kits; the structure of typical microcontrollers and their main links, the development of ways to expand the functionality; principles of programming of microprocessor systems and microcontrollers in the Proteus environment.	3	LO -2
25	Digital Signal Processing Techniques	Methods of digital signal processing using digital signal processors; methods of designing digital filters methods of their implementation on digital signal processors; structure and characteristics of signal processors.	3	LO -2
26	Research practice	The main purpose of the research practice of the undergraduate is to study the theoretical, methodological and technological achievements of domestic and foreign science, as well as practical skills in the application of modern methods of research, processing and interpretation of experimental data in the dissertation research.	12	
27	Research work of a master's student, including the completion of a master's thesis. NIRM	The aim of the research work is the integration of the educational process with the development of professional activities in the areas of training of masters to ensure the formation of students ' research competencies required for research and solving professional problems.	11	
28	Research work of a master's student, including the completion of a master's thesis. NIRM	The aim of the research work is the integration of the educational process with the development of professional activities in the areas of training of masters to ensure the formation of students ' research competencies required for research and solving professional problems.	**6**	
29	Final certification	final certification of students – a procedure carried out to determine the degree of development of the volume of educational disciplines provided by the state educational standards;	12	
30	Comprehensive exam	Complex examination is conducted in the form of interdisciplinary	3	

		examination. Its task is to determine the level of development of undergraduates educational material provided by the curriculum and covers the main content of the disciplines that form the basis of training		
31	Preparation and defense of a master's thesis	When writing a master's thesis masters analysis of the literature, the study of objects of digitalization, and presentation of results of research, reports and presentations for scientific and professional activities, etc. b. the ability to publicly display known and General results on the form.	9	