**MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN**

**NON-PROFIT JOINT STOCK COMPANY "ALMATY UNIVERSITY OF ENERGY AND COMMUNICATIONS NAMED AFTER GUMARBEK DAUKEEV "**

**Institute of Control Systems and Information Technologies**

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| **"Agreed"** | **"Approved"** |
| President of the Association | AUEC Rector |
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| «\_\_\_»\_\_\_\_\_\_\_\_\_\_\_\_\_\_2020 г. | «\_\_\_»\_\_\_\_\_\_\_\_\_\_\_\_\_\_2020 г. |

**MODULAR EDUCATIONAL PROGRAM**

**DIRECTION «7М06102 -** **INFORMATION SYSTEMS»**

(MASTER SCIENTIFIC AND PEDAGOGICAL DIRECTION)

**POSTGRADUATE EDUCATION**

**Field of education (according to the classifier of 13.10.2018):**7M06 - Information and communication technologies

**Direction of training (according to the classifier of 13.10.2018):**7M061 - Information and communication technologies

**Training period - 2 years**

**Awarded academic degree -***Master of Engineering and Technology*

**Qualification level in accordance with the National Qualifications Framework:**level 7 .

**Almaty 2020**

**Trajectories (specializations) of training:**

The EP was 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 minutes 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 Resolution of the Government of the Republic of Kazakhstan dated 23.08.2012 No. 1080 (as amended by the Resolution of the Government of the Republic of Kazakhstan. Order of the Minister of Education and Science of the Republic of Kazakhstan dated 31 October 2018 No. 604. Registered with the Ministry of Justice of the Republic of Kazakhstan 1 November 2018 No. 17669.); Professional standards or draft standards.The educational program was developed at the Department of IT Engineering.

Head of the educational program Tussupova B.

In the development of educational programs participated: Amanbaev AA, candidate of technical sciences, assistant professor.

The EP was considered and approved at a meeting of the IT-engineering department of 03.04.2020, protocol № 8.

Head of the IT-engineering department \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Doszhanova A.

The EP was considered and approved at a meeting of the educational and methodological commission of the Institute of Control Systems and Information Technologies (Minutes No. 8 dated 03/05/2020).

Head of the ICSIT\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Kartbayev T.

The ЕP was reviewed and approved by the SMC AUPET (Minutes № 12 dated April 14, 2020).

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**List of symbols and abbreviations**

|  |  |
| --- | --- |
| HE | - Higher education |
| SCES | - State compulsory education standard |
| EQF | - European qualifications framework |
| NCO | - National classifier of occupations |
| RK | - The Republic of Kazakhstan |
| NQF | - National qualifications framework |
| NSQ | - National system of qualifications |
| GEM | - General educational module |
| EP | - Educational program |
| GED | - General education disciplines |
| RC | - Required component |
| UC | - University component |
| BD | - Basic disciplines |
| MD | - Major disciplines |
| IET | - Individual educational trajectory |
| IQF | - Industry qualifications framework |
| PS | - Professional standard |
| PE | - Postgraduate education |
| ОN | - Competencies |
| LO | - Learning outcome |
| CW | - Course work |
| SGW | - Settlement and graphic work |
| RWS | - Research work of students |
| CED | - Catalog of elective disciplines |

**Passport of the educational program**

|  |  |  |
| --- | --- | --- |
| **№** | **Field name** | **Note** |
| 1 | Registration number | 7М06100033 |
| 2 | Education area code and classification | 7М 06 Information and communication technologies |
| 3 | Code and classification of areas of training | 7М061 Information and communication technologies |
| 4 | Group of educational programs | В057 - Information technologies |
| 5 | EP name | 7М 06102 - Information systems |
| 6 | EP type | Current EP |
| 7 | The purpose of the EP | providing comprehensive and high-quality training of qualified, competitive specialists in various fields of application of information systems and the development of students' personal qualities, as well as the formation of general cultural universal (general scientific, social and personal, instrumental) and professional competencies. |
| 8 | ISCED level | ISCED 7 Master or equivalent |
| 9 | NQF level | 7 |
| 10 | ORK level | 7 |
| 11 | Distinctive features of the EP | No |
| Partner university (SOP) | No |
| Partner university (DDOP) | No |
| 12 | List of competencies | ON-01. Applying of the theory and methods of the humanities, social and scientific-pedagogical sciences on practice in various types of professional activities  ON-02. Conduction of scientific research in the field of ICT and processing of experimental results, including using technical means and complexes.  ON-03. Providing of comprehensive security systems, research, applying methods and means of protecting computer information.  ON-04. Usage and development of methods of scientific research in the field of IS design and WEB applications development.  ON-06. Exploring of design, technological and methodological solutions; leading of IT projects and managing of projects.  ON-07. Getting of knowledge of the theory of neural networks, genetic algorithm and their applications in IS. Ability to develop methods for teaching neural networks to solve applied problems.  ON-08. Ability to formulate the problem of making decisions, finding the methods for solving and developing of algorithms for their implementation. |
| 13 | Learning outcomes |
| 14 | Mode of education | Full-time |
| 15 | Language of education | Russian, Kazakh, English |
| 16 | Loan volume | 120 |
| 17 | Awarded academic degree | Master of Engineering and Technology |
| 18 | Availability of an annex to the license for the direction of personnel training | **License number № 0137445**  **License issue date 04.08.2010** |
| 19 | Availability of EP accreditation | Available |
| Accreditation body name | IAAR NU "Independent Agency for Accreditation and Rating" |
| Period of validity of accreditation | 05.04.2019-04.04.2024 |
| 20 | Information about disciplines | Information about disciplines UK/EK BD, MD (Appendix 1) |
| 21 | Sphere of professional activity | The spheres of professional activity of graduates are public and private enterprises and organizations that develop, implement and use computers and software in various fields, namely: mechanical engineering, metallurgy, transport, telecommunications, science and education, health care, agriculture, in the service sector, administrative management, economics, business, management of various technologies, that is, in almost all spheres of human activity. |
| 22 | Professional activities | Specialist for work in research universities, research and design institutes, universities, energy enterprises capable of performing the following types of professional activities:  - design and engineering;  - production and technological;  - experimental research;  - organizational and managerial;  - operational. |
| 23 | Modular curriculum | Provided in Appendix 2 |

**1. The structure of the educational program of higher education**

The list of disciplines of the university component and the optional component is determined by the university independently. 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 DB cycle of all educational programs of the master's degree in scientific and pedagogical direction in accordance with the State Educational Standard includes the disciplines "History and Philosophy of Science", "Foreign Language (Professional)", "Pedagogy of Higher Education", "Psychology of Management".

In the master's degree in scientific and pedagogical direction, the volume of the DB cycle is 29% of the total volume of the educational program of the master's program or 35 academic credits. Of these, 57% or 20 academic credits are allocated to VC.

In the 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 7M06102- "Information Systems" meets the requirements of the state compulsory standard of postgraduate education and the structure of the educational program of postgraduate education (master's degree in scientific and pedagogical direction), contains all the necessary components, has a university and variable components. The modular program meets the minimum requirements for the number of credits for theoretical training -108 and 12 credits for final certification (10%). The terms 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 variational component is defined in the catalog of elective disciplines.

Appendix 3

to the state compulsory

standard of postgraduate education

The structure of the Master's programs in scientific and pedagogical direction

|  |  |  |  |
| --- | --- | --- | --- |
| № | Name of cycles of disciplines and types of activities | Total labor intensity | |
| in academic hours | in academic credits |
| *1* | *2* | *3* | *4* |
| 1. | Theoretical teaching | 1920 | 64 |
| 1.1 | Cycle of basic disciplines (BD) | 1050 | 35 |
| 1) | University component (UC) | 600 | 20 |
|  | including: |  |  |
|  | History and philosophy of science |  |  |
|  | Foreign language (professional) |  |  |
|  | Higher education pedagogy |  |  |
|  | Psychology of management |  |  |
|  | Teaching practice |  |  |
| 2) | Optional component (OC) | 450 | 15 |
| 1.2 | The cycle of profiling disciplines (PD) | 1470 | 49 |
| 1) | University component (UC) |  |  |
| 2) | Optional component (OC) |  |  |
| 3) | Internship |  |  |
| 2 | Research work | 720 | 24 |
| 1) | Research work of a master student, including an internship and a master's thesis (RWMS) | 720 | 24 |
| 3 | Additional types of education (ATE) |  |  |
| 4 | Final certification (FC) | 360 | 12 |
| 1) | Registration and defense of the master's thesis (RaDMT) | 360 | 12 |
|  | Total | 3600 | 120 |

**2. Catalog of elective disciplines**

The catalog of elective disciplines is formed for the entire period of study, but it is not static, but 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 attend a modern professional course, leading specialists from leading universities in the world.

QED 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 an integrated approach, when both educational programs themselves and curricula and academic disciplines are formed according to the modular principle.

With the possession f and the volume of each module varies uetsya depending on the didactic purposes, profile oh and tier differentiation of students and the entire teaching program struktu p and Rowan in the autonomous organizational and methodological modules .

The formation and content of modules provides the necessary degree of flexibility and freedom for students in choosing 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 should be obtained. An individual educational trajectory consists of university (compulsory), variable, correctional and organizational parts. The compulsory part includes the main modules for studying, which correspond to the structure of the educational program of postgraduate education. The variable part includes a set of modules and their constituent parts, which the undergraduate chooses for study, depending on the areas of study that interest him. The compulsory and optional parts are aimed at determining the content of training. Already in the first year of study, the undergraduate chooses the specialization of training and in the variable part of the educational program selects a module of special training, which is mandatory for study.

The correctional part provides for assisting students in choosing the disciplines of the variable part of the modules and variable modules, taking into account their individual characteristics, as well as determining the organizational part. The organizational part includes the following components of the system: forms, methods, technologies, means, control of the study of the selected content.

Table 4.1 presents the organizational components of the IET training.

Table 4 .1 Organizational component of IET training

|  |  |  |
| --- | --- | --- |
| Asynchronous elements | Ensuring asynchronous learning | Asynchronous tools |
| 1. Independent work of a master student 2. Choice of disciplines of the variable component 3. Selection of an additional training profile, within the framework of academic exchange and scientific internships | Office of PhD and Master Programs | Working curriculum; Timetable of classes;  Schedule of consultations for teachers of the Union of Youth Union monitoring the implementation of the curriculum |
| Departments, Advisors, Tutors | Individual master's curriculum |
| Teachers | EMCD, schedule for the implementation and delivery of tasks, list of recommended literature |
| Undergraduates | Library, electronic editions, Internet, syllables |

Table 4 .2 presents the content component of the IET training. The content component concretizes the options for the formation of an 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 SCO University) , and obtain a second diploma at a partner university .

Table 4 .2 Content component of IET training

| IOT options | Ensuring asynchronous learning | Asynchronous tools |
| --- | --- | --- |
| Individual set of competencies | Tutors, undergraduates | Individual master's curriculum |
| Departments, scientific leaders | A set of variable disciplines, Individual work plan of a master student |
| Office of PhD and Master Programs | Working curriculum |
| Specification of the training profile (SGW, CW, research work) | Tutors, undergraduates | Individual master's curriculum |
| Departments, scientific leaders | Approximate topics of the CW, topic of the SGW, topic of the ERWMS |
| Individual level of mastering disciplines (high, medium, low) | Undergraduates, scientific advisers | Regulations on the point-rating system of assessment, schedule of assignments, experimental research work, practice |
| Professional adaptation to professional activity during practice | Undergraduates, departments, scientific advisers, OPDM | Practice programs, contracts with enterprises on practice bases, the formation of individual assignments for practice |
| Extended set of professional competencies (choice of additional training profile) | Scientific advisers, undergraduates | Individual work plan of a master's student |
| OPDM, undergraduates, scientific advisers, AUPET international department | Non-linear timetable, the main educational program of the additional profile of training, professional development courses, internships, a list of disciplines (credits) within the SCO University, a list of credits within the framework of academic mobility |

The master's student carries out the study of cycles of basic and major disciplines of the variable component in accordance with the chosen direction of training. When choosing variable disciplines, the direction of work on the master's thesis and the advice of the supervisor are taken into account. In the fourth semester, preparations are underway for the final attestation, research practice is carried out, issues with the specific content of the dissertation are resolved during the period of research practice. After the choice of disciplines, undergraduates will master 30 credits in the first, second and third semester. Must have mastered Pedagogical and Research Practice, Research Work and Final Assessment.

The volume of disbursed loans in the context of modules and training courses is presented in the summary table 4 .3.

The possibilities of the educational program are great, the formation of additional modules in the cycle of majoring disciplines in the variable part of the program can be prepared by a specialist in a wide variety of specializations, keeping up with the times.

Table 4 .3 Summary table reflecting the volume of disbursed loans in the context of educational program modules

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course of Study | Semester | Number of mastered modules | Number of disciplines | | Number of KZ credits | | | | | | Total in hours | ECTS | Amount | |
| UK | UC | Theoretical teaching | Pedagogical  practice | Internship | Research work | Final examination | Total | Exam | 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 | CE | 2 |
| Total : | |  | 5 | 11 | 69 | 4 | 11 | 24 | 12 | 120 | 3600 | 120 | 16+CE | 7 |

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**Appendix 2**

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

| **No.** | **Name of the discipline** | **Brief description of the discipline**  **(30-50 words)** | **Number of credits** | **Formed competencies (codes)** |
| --- | --- | --- | --- | --- |
| **Cycle of general education disciplines**  **University component / Component of choice** | | | | |
| 1 | History and philosophy of science | As a result of studying the discipline, undergraduates can apply methodological and methodological techniques and knowledge in scientific research, pedagogical and educational work, analyze and comprehend the realities of modern theory and practice based on the history and philosophy of science. | 3 | ON 1 |
| 2 | Foreign language (professional) | The discipline "Foreign language" is aimed at developing speech skills of oral and written communication in a foreign language, reading and translating texts according to the profile of preparation, producing monologic statements. As a result of studying the discipline, they will be able to demonstrate knowledge of word-formation models, contextual meanings of polysemous words, terms, lexical structures, as well as grammar and syntax of a technical language; search skills , processing and and selection of information from foreign-language scientific and technical literature . | 5 | ON 1 |
| 3 | Higher education pedagogy | As a result of studying the discipline "Pedagogy"  to reveal the main methodological provisions of pedagogical science, its basic laws, principles within the framework of the processes of teaching and upbringing in higher education, didactics, systemic, activity-based, technological and personality-oriented approaches as a methodology of pedagogy, as well as methods, problems and prospects for its development. | 5 | ON 1 |
| 4 | Psychology of management | Development of students' professional reflection in the field of psychology, the effectiveness of which depends on a scientific approach, psychological competence and skillful use of psychological resources. Thus, the need to develop the psychological and pedagogical competence of specialists in the new conditions of social development determines the relevance of this course in the system of higher professional education. Stimulate the development of interest in practical psychological activity. | 3 | ON 1 |
| **Cycle of majors**  **University component** | | | | |
| 5 | Analysis, modeling and design of information systems | As a result of studying the discipline, undergraduates will master the competence of using computational experiments and object- oriented analysis apparatus in modeling and designing information processes in IS. They will acquire the skills to use a systematic approach in the research, design and operation of IS, as well as develop modeling algorithms and implement them using algorithmic languages ​​and software packages for modeling . | 6 | ON 2 |
| **Cycle of basic disciplines**  **Optional component** | | | | |
| 6 | Multi-criteria decision-making problems | As a result of studying the discipline, students will receive in-depth knowledge of the principles of creating information systems based on mathematical modeling using analytical, numerical and simulation methods; optimization of information systems, taking into account the requirements for the quality of their functioning. | 5 | ON 2, ON 8 |
| System analysis and operation research | As a result of studying the discipline, students will master the principles of a systematic approach when considering and analyzing the organization of economic and management activities, considering the basic principles of decomposition and synthesis in analyzing systems, classifying system analysis problems, principles of resource optimization, methods of conditional and unconditional optimization, methods of linear, parametric and dynamic programming. | 5 | ON 2, ON 8 |
| 7 | Designing and analyzing Web interfaces | As a result of studying the discipline, students will master the technologies and methods of creating WEB-interfaces, methods of designing client WEB applications and server Javaweb applications, they will be able to gain knowledge of the principles of organization and functioning of WEB applications on the Internet. M **agistrants**will be able to apply technologies for creating websites, which will have to be considered comprehensively, because in recent years, the methods of organizing the work of the Internet have developed significantly. | 5 | ON 4 |
| Design tools and the development of web -sites | As a result of studying the discipline, students will gain knowledge on the professional construction of information systems intended for placement on Web resources, the masters will develop the necessary practical skills for the design and implementation of information systems of varying complexity, the use of modern computer technology and software to solve practical problems of creating web applications ... | 5 | ON 4 |
| 8 | Data mining | As a result of studying the discipline, students will master theoretical knowledge and practical skills in the development and use of systems for processing and analyzing large data arrays, which allows them to perform the following professional tasks: setting the problem of big data analysis, preprocessing data, visualizing data, developing, implementing and applying methods of intelligent data analysis to large amounts of data, presentation of work results. | 5 | ON 2, ON 5 |
| Big data processing technologies | As a result of studying the discipline, students will master theoretical knowledge and practical skills in the development and use of systems for processing and analyzing large data arrays, which allows them to perform the following professional tasks: setting the problem of big data analysis, preprocessing data, visualizing data, developing, implementing and applying methods of intelligent data analysis to large amounts of data, presentation of work results. | 5 | ON 2, ON 5 |
| **Cycle of majors**  **University component / Component of choice** | | | | |
| 9 | Data management in information systems | As a result of studying the discipline, students will gain theoretical knowledge and practical skills in automating the analysis of information preparation for making managerial decisions using modern tools of widespread use and specialized software packages; mastering the basics of developing and maintaining data loading systems, information storages, technologies for operational and data mining, reflecting activities in various subject areas. | 3 | ON 5, ON 6 |
| Information systems architecture | The architecture of information systems plays an important role in the formation of basic knowledge and skills of a modern specialist in the field of information systems and technologies. The main task of this course is to form general theoretical ideas and concepts about the organization and principles of construction, models of functioning of information systems in various fields.  ... | 3 | ON 5, ON 6 |
| 10 | M enedzhment ІT- projects | As a result of studying the discipline, students will form theoretical knowledge and practical skills in organizing the management of the IT infrastructure of an enterprise, based on the concept of information service, information systems management model (ITSM), ITIL library (IT InfrastructureLibrary). | 3 | ON 6 |
| Project Management Information Systems | As a result of studying the discipline, students will receive theoretical knowledge and practical skills in applying a complex of technological and organizational techniques and tools that support project management in organizations and contribute to improving the efficiency of their implementation. | 3 | ON 6 |
| 11 | Development of information systems using  visual programming tools | As a result of studying the discipline, students will gain knowledge about a deep understanding of the capabilities of the C # programming language for developing controls, creating client and server applications; know the basic elements of the .NETFramework and the relationship with C # with elements of the .NET framework; **be able to**apply the acquired skills to solve standard scientific and professional problems; research of problems in the field of classical and modern approaches to building the interface and information structure of the toolkit. | 6 | ON 4 |
| Multithreaded programming | As a result of studying the discipline, students will gain knowledge about platforms performing parallel computing; to achieve more efficient use of computing machine resources; know the tools for developing parallel programs for multiprocessor systems; principles of development of science in multithreaded programming and in the possibility of using new technologies ; the ability to manage threads on different processors is the task of the OS. | 6 | ON 4 |
| 1 2 | Theory and practice of project management | Formation of a set of theoretical knowledge and practical skills related to understanding the role of the project in the organization in the field of procurement, the main provisions of the modern concept of project management, project management techniques using economic and mathematical methods, the study of the methodology of analysis and synthesis of solutions in the formation of effective management decisions within the framework of contract systems; development of skills in the design technology of effective multi-project management solutions . | 5 | ON 6 |
| Innovative systems | Undergraduates will be able to find and practice solutions to the key tasks of a manager in the implementation of projects at all phases of his life cycle - from initiation to completion. The main objective of the course is to provide participants with the opportunity to make decisions on various issues of project management using a model example. | 5 | ON 6 |
| 13 | Integrated security of information technologies and systems | As a result of studying the discipline, students will receive theoretical knowledge and practical skills to ensure integrated security of information technologies and systems at modern enterprises in accordance with the requirements of legal regulations, regulatory methodological documents of the Republic of Kazakhstan and world advanced innovative technologies. | 6 | ON 3 |
| Methods and means of protecting computer information | As a result of studying the discipline, students will develop theoretical knowledge and practical skills in developing an enterprise security policy, identifying threats to information security and choosing methods and means to ensure the protection of computer information. | 6 | ON 3 |
| 14 | Artificial intelligence methods in information systems | As a result of studying the discipline, students will gain knowledge and practical skills on the general provisions of the theory of artificial neural networks and its application in IS, on the structure of single-layer and multilayer neural networks, develop specific methods for teaching a neural network, classify learning algorithms, determine the class of problems solved using the perceptron ... | 6 | ON 7 |
| Knowledge Engineering and Intelligent Systems | As a result of studying the discipline, students will gain knowledge and practical skills on modern models of knowledge representation, promising directions for the development of artificial intelligence systems and decision-making, the theoretical foundations of artificial intelligence (AI) systems, about Data Mining, learn to apply intelligent automated information systems, extract knowledge in information systems ... | 6 | ON 7 |
| 15 | Architecture and technology of computer networks | As a result of studying the discipline, students will gain knowledge about modern routing protocols, the design of modern networks, the principles of routing optimization, the use of multiple routing punctures in a hierarchical network, the operation of the IPv6 protocol; understand the capabilities of the IPv6 protocol, extended address space, IPv6 addressing architecture, MPLS multi-protocol switching, Softswitch technology, multi-service network control devices . | 3 | ON 2 |
| Computer networks and telecommunications | As a result of studying the discipline, students will master the competence of analyzing the functioning of computer and communication systems based on modern telecommunication equipment, network technologies and protocols; administration of corporate networks, taking into account their fault tolerance, scalability and quality of service. | 3 | ON 2 |