ХАЛЫҚАРАЛЫҚ
УНИВЕРСИТЕТІ
МЕЖДУНАРОДНЫЙ
УНИВЕРСИТЕТ
INTERNATIONAL UNIVERSITY

<table>
<tr><td>AGREED
Executive director of
«Internet Society Kazakhstan» PO
_____ Nurlybayev T.A.
«___»_____2023</td><td>APPROVED
Rector
of JSC «International Information
Technology University»
_____ Hikmetov A.U.
«___»____03____2023</td></tr>
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EDUCATIONAL PROGRAM

6B06107« Cyberphysical Systems»

Code and classification of the field of education: 6B06 – Information and Communication Technology

Code and classification of training area: 6B061 – Information and Communication Technology

Group of educational programs: B057 – Information Technology

ISCED level: 6

NQR level: 6

ORC level: 6

Duration: 4 years

Number of credits: 240

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<tr><td>AGREED
Director of
«KnewIT Programming School» LLC
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«___»_____2023</td><td>AGREED
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Almaty, 2023

Content

List of abbreviations and notation

BC	Basic competence
BM	Base module
HE	Higher education
SCES	State compulsory education standard
EQF	European qualification framework
EEF	European Education Foundation
KSC	Knowledge, skills, cum-savvy
NCO	National Classification of Occupations
NQF	National Qualifications Framework
NQS	National qualifications system
HM	Humanitarian module
CM	Common module
EP	Educational program
GPM	General Professional Module
IQF	Industry Qualifications Framework
PS	Professional standard
PE	Postgraduate education
PC	Professional competence
PM	Professional module
SW	Software
WG	Working group
RK	The Republic of Kazakhstan
LO	Learning outcome
SM	Special module
QMS	Quality Management System
SEM	Socio-economic module
TVE	Technical and vocational education
TaVPE	Technical and vocational education and post-secondary education
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO	Specialized agency of the United Nations Educational, Scientific and Cultural Organization
Cedefop	European Center for Development of Vocational Training
DACUM	from Eng. Developing curriculum
ECVET	European Credit System for vocational education and training
EQAVET	European Quality Assurance in Vocational Education and Training
ENQA	European Association for Quality Assurance in Higher Education / Europe-Skye association by to ensure qualities at higher education
ESG	Standards and Guidelines for Quality Assurance in the European Higher Education Area
FIBAA	International Agency (non-profit foundation) for accreditation and examination of the quality of higher education (Bonn, Germany)
IQM-HE	Internal Quality Management in Higher Education
TACIS	Technical Assistance for the Commonwealth of Independent States
WSI	WorldSkills International

1 Description of the educational program

The basis for the development of the educational program 6806107 "Cyber-Physical Systems" is the need to train qualified specialists in the field of robotics and info-communication systems, who have the necessary knowledge to develop and maintain software products, who have the necessary practical skills in the field of hardware construction of information and communication systems that have engineering thinking.

Currently, new types of robotic systems are developing rapidly and are in demand. There is a wide experience in the use of robots and flexible production systems in industry and production. Their application requires a new organization of the technological process and, as a result, special training of specialists in this field. Only under this condition, industrial robots and robotization production can give the greatest effect when applied.

Robotic systems with adaptive and intelligent robots need microprocessor-based distributed control. Therefore, the training of specialists of this level requires systematic training and affects the development of this subject area. This profession requires knowledge of artificial intelligence from a specialist and includes the creation and operation of devices and systems based on the use of information processing, the ability to solve problems of developing and maintaining software products, research and development of robotic technologies, creation of models of robotic systems, ability to create smart technical systems for obtaining information about technical objects, modeling of robots, prototyping of robots.

2 The goal and objectives of the educational program

The purpose of the EP is to provide practice-oriented training of highly qualified specialists in the field of robotics and production and management activities related to the process of creating the use of fundamentally new technical means of integrated automation of production processes of robotic systems for the manufacturing industry of the Republic of Kazakhstan.

The objectives of the EP:

1. Formation of knowledge, skills and abilities in designing and operating specialized software hardware for industrial use, organizing database systems, information processing and storage systems, designing and administering local and corporate computing systems and networks, automating business processes.

2. Obtaining knowledge, skills and abilities in the field of network and telecommunication technologies, system, applied, software and hardware

3. Providing training for bachelors in robotics, researching the theory, development and application of robotic technologies. Development of skills in the application of information technologies for robotics, machine learning, artificial intelligence and design of robotics systems, as well as the creation of new generation technical systems designed for industrial robotics

4. Development of respect for the university Ensuring demand, mobilityspecialties, obtaining high-quality knowledge and the ability to work in a team

5. Formation of competitive graduates in the labor market, which would provide an opportunity for the fastest possible employment in their specialty. 6. Training of specialists in management activities related to the field of robotics production and the process of creating C and using: a fundamentally new technical means of integrated automation of production.

6. Training of specialists in the field of robotics of production and management activities related to the process of creating and using a fundamentally new technical means of integrated automation of production processes of robotic systems.

7. Creation of conditions for professional growth and self-improvement, development of social and personal competencies of graduates in the formation of a sustainable interest in robotics (active citizenship, purposefulness, organization; diligence, sociability, the ability to make organizational and managerial decisions to stimulate creative activity, possession of modern information technologies , fluency in several languages, the desire for self-education and self-development, the ability to work in a team, responsibility for the final result of their professional activities, familiarization with universal values), social mobility and demand in the labor market.

3 Requirements for the results of the mastering of the educational program

The following examination forms are used as an assessment of learning outcomes: computer testing, a written exam (answers on the sheets), an oral exam, a project (passing a course project), practical (open questions on a computer, solving problems on a computer, including in ACM format) comprehensive (test / written / oral + others). In accordance with table 1, the following exams are recommended:

Table 1

№	Exams form	Recommended share, %
1	Test	10%
2	Written	10%
3	Oral	5%
4	Project	30%
5	Practical	30%
6	Complex	15%

Final attestation is help on the form of defending a diploma project.

4 Passport of the educational program

4.1 General information

№	Field name	Note
1	Code and classification of the field of education	6B06 – Information and Communication Technology
2	Code and classification of training areas	6B061 – Information and Communication Technology
3	Group of educational programs	B057 – Information Technology
4	Name of the educational program	6B06106 Computer Systems and Software Engineering
5	Short description of the program	The educational program "Cyberphysical Systems" is aimed at training specialists in the development of various robotic technologies.
6	Purpose of EP	To provide practice-oriented training of highly qualified specialists in software development in various fields with competencies in the field of data analysis, network technologies, robotics and graphic computing
7	ISCED level	6
8	NQF level	6
9	IQF level	6

10	List of competencies :
	GC1: To know: socio-ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities; history, traditions and culture of the peoples of Kazakhstan; human and civil rights and freedoms; fundamentals of the legal system and legislation of Kazakhstan; trends in the social development of society; the basics of physical culture and the principles of a healthy lifestyle.
	GC2: To be capable of written and oral communication, including professional in the state language, the language of interethnic communication and English; ability is logically true, reasoned and clearly build oral and written speech.
	BC1: To be competent in the choice of mathematical modeling methods for solving specific engineering problems, including the willingness to identify the natural science essence of the problems arising in the process of professional activity, and the ability to attract the appropriate physical and mathematical apparatus for its solution.
	BC2: The ability to use modern information and communication technologies in substantive activities, to analyze information sources.
	BC3: The ability to analyze the architecture of computer systems, the main components of a computer.
	PC1: The ability to formalize the subject area of a software project and develop specifications for software product components.
	PC2: The ability to design and develop user interfaces, commercial software components, databases and embedded software modules.
	PC3: To be competent in choosing software, DBMS, programming language.
	PC4: The ability to manage the software development process, the development team, as well as evaluate the economic efficiency of the project.
	PC5: The ability to design, configure, operate computer systems and networks.
	PC6: The ability to analyze various types of data, apply knowledge extraction methods.
	PC7: The ability to design, develop and operate robotic systems.
	PC8: The ability to develop three-dimensional visualizations using modern technologies.
11	Learning outcomes. Students will be able to:
	LO1: Demonstrate the ability to use basic math tools to solve professional problems.
	LO2: Analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor.
	LO3: Apply suitable data structures and develop appropriate algorithms for solving various computational problems.
	LO4: Apply various tools for software development, user interface, storage and data processing systems.
	LO5: Use various software development methodologies, draw up software documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process.
	LO6: Develop effective data storage systems and methods for their processing and analysis using machine learning algorithms.
	LO7: Own technologies for administering systems and networks of any configuration, troubleshooting and threat prevention.
	LO8: Design, operate and maintain robotic systems.
	LO9: Demonstrate the skills to develop complex three-dimensional visualizations using computer vision technologies, augmented and virtual realities.
	LO10: Independently critically analyze modern sources, draw conclusions, argue them and make decisions based on information.
12	Form of study	Full-time
13	Language of instruction	English
14	Number of credits	240 ECTS credits

15	Awarded academic degree	Bachelor in Information and Communication Technology in educational program 6B06107 «Cyberphysical Systems»
16	Developers and authors:	«International Information Technology University» JSC, Computer Engineering and Information Security Department: - Chinibayeva T.T., PhD, head of the «CEIS» department, Assistant prof., - Tokanov O.S., MSc, senior lecturer

4.2 Matrix of correlation of learning outcomes of the educational program with competencies

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10
BC1	V									
BC2										V
BC3		V								
PC1					V					
PC2			V	V		V				
PC3			V	V						
PC4					V					
PC5							V			
PC6						V				
PC7								V		
PC8									V	

4.3 Information about courses

Code of the course	Name of the course	Short description of the course	Number of credits	Formed competencies (codes)
		General disciplines (GD)		
		Mandatory component (MC)		
ICT6001	Information and Communication Technologies	The skills of applying information and communication technologies in substantive activities are taught.	5	KCK1
LAN6001A	Foreign language	Written and oral communication skills in English are taught.	5	KC8
LAN6002A	Foreign language	Written and oral communication skills in English are taught.	5	KC8
PhC6005	Physical Culture	The ability to understand the practical use of healthy living standards, including prevention issues, is being instilled.	4	
PhC6006	Physical Culture	The ability to understand the practical use of healthy living standards, including prevention issues, is being instilled.	4	
LAN6001KR	Kazakh (Russian) language	The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated.	5	KC8
LAN6002KR	Kazakh (Russian) language	The skills of written and oral communication in the state language (the language of interethnic communication) are inculcated.	5	KC8
HK6002	History of Kazakhstan	The laws of the historical process, the place of man in the historical process are studied. Historical knowledge is given about the main stages of development of modern Kazakhstan; focuses on the problems of historical and cultural processes and the development of Kazakhstan.	5	KC8
SPS6001	Philosophy	Studying the principles of understanding philosophy as a methodology of human activity, the main directions and problems of the world. The formation of a holistic vision of philosophy as a special form of knowledge of the world, its main problems and methods of studying them in the context of future professional activity.	5	KC8
SPS6004	Cultural studies	The course is aimed at implementing fundamental ideas for the preservation of the cultural heritage of Kazakhstanis and the national code in the context of globalization, the modernization of public consciousness and human spirituality in the process of developing national art and cultural institutions.	2	KC8
SPS6005	Psychology	The course is aimed at teaching students of non-psychological specialties. The basics of psychological science are considered, including topics such as an introduction to psychology, activity psychology, cognitive processes, personality psychology.	2	KC8
SPS 6002	Sociology	The development of sociological imagination, understanding of sociology as a science. The study of sociological subject areas, directions and research methods. The basic concepts of sociological theories are discussed, as well as how society and social processes determine our life.	2	KC8
SPS6003	Political science	The fundamentals of global political processes and the laws of political life are being studied.	2	KCK8
ECO6002	Economics and organization of production	New trends in the economy and organization of production are discussed with examples from real life and practice. The structure of the national economy, the enterprise and the organization of its production, capital and property of enterprises, material resources, wages and costs of production, income, profit, profitability, competitiveness, economic efficiency of production are considered.	5	KC2

Basic disciplines (BD)				
University component (UC)				
MAT6001**	Algebra and geometry	Studying the elements of linear algebra and analytic geometry using real life and various science examples.	4	KC2
NET6301	Introduction to computer networks	Acquaintance with the basic network concepts and technologies, as well as developing the skills of planning and implementing small networks. The architecture, structure, functions, components and models of the Internet and other computer networks are considered. The principles and structure of IP addressing, as well as the basics of Ethernet concepts, media and operations, are presented as the basis for the curriculum.	5	KC1, KC5, KC7
SFT6301	Algorithmization and programming	More complex, advanced algorithms and data structures using the C ++ programming language are considered.	6.	KC3-4 KC6
HRD6301	Introduction to robotics	Comprehensive and comprehensive coverage of robotics as a science and technology. It covers topics from basics to advanced applications and services, providing students with practical experience with Arduino and desktop robots.	6	KC1-8
MAT6002	Mathematical analysis	We consider such concepts as limits and differentiation of functions of one variable, indefinite and definite (Riemannian) integrals of functions with applications, as well as an introduction to topics related to ordinary differential equations.	6	KC2
PHY6001	Physics	Studying the basic laws of classical mechanics, electricity, magnetism, thermodynamics, quantum mechanics, special relativity in search of ways to solve physical problems.	7	KC2
PP6301	Educational practice	The acquisition of primary professional skills and the consolidation of skills by independently solving the problems of algorithmization, design and practical implementation of programs using modern programming technologies.	2	KC3 KC4 KC6
SFT6305	Database design. Introduction to SQL	During the course, students will learn how to create relational databases, going through all the stages of the database design process (conceptual, logical and physical). In the second part of the course, students will learn the basics of Structured Query Language (SQL).	5	KC3 KC4 KC6
EEC6001	Basic circuit theory	Familiarity with the fundamental principles of the theory of electrical circuits. The basic concepts are considered, such as voltage, current, resistance, Ohm and Kirchhoff law; main methods for analyzing electrical circuits, resistive circuits, circuits with a constant and sinusoidal voltage source, stationary power.	4	KC2 KC5 KC7
MAT6005	Discrete mathematics	The study of discrete objects, the solution of combinatorial problems, the study of types of mappings and binary relations, the reduction of propositional algebra formulas to normal forms, the application of logic algebra to the theory of switching circuits. The capabilities for analysis and synthesis, and mathematical maturity are developing.	4	KC2
SFT6302	Algorithms and data structures	The principles of algorithm development, analysis of algorithms and fundamental data structures are considered. The emphasis is on choosing appropriate data structures and developing effective and correct algorithms for their implementation. Important elements of the course are measuring the performance and effectiveness of programs when comparing and comparing the results of small programs written in different languages.	4	KC3 KC4 KC6
SFT6304	Programming in Python language	Familiarity with the Python programming language and its libraries. The emphasis is on procedural programming, non-strict types of variables, designing algorithms, working forms of applications (libraries), object-oriented programming, creating web and database applications, as	4	KC3 KC4 KC6

		well as data preprocessing.		
SFT6306	Software architecture and design	The study of large systems and how they are decomposed into subsystems and components. Various notations and formalisms, detailed design and architecture are considered. The use of various notation with an emphasis on UML is explored. The role of architecture and detailed project specifications are considered in terms of risk management.	4	KC3 KC4 KC6
EEC6004	Fundamentals of logic design	Acquaintance, development and application of digital logic circuits, including combinational and sequential logic circuits.	5	KC2 KC5 KC7
MAT6006	Probability theory and mathematical statistics	The course focuses on the probability and statistics of any events, as well as on the relationship between mathematics and programming through an interdisciplinary training program that deepens the mathematical understanding of probability and develops the skills of logical and algorithmic thinking.	4	KC2
EEC6003	Design and simulation of electronic devices	The study of semiconductor materials, their characteristics, principles of operation and application. The physics of semiconductors, diodes of p-n junctions, heterojunctions, transistors, metal-semiconductor contacts are considered.	5	KC2 KC5 KC7
HRD6304	Sensor technologies	Familiarity with the various types of sensors that are used for industrial automation, environmental assessment, as well as for human-computer interaction.	7	KC2, KC3, KC5-7
LAN6007K	Business correspondence in the state language	Business language skills are taught. The formation and development of listening, speaking, reading and writing skills on topics related to professional activities, as well as the development of social skills such as presentations.	2	KC8
SFT6002	Object oriented programming	The course is devoted to the principles of object-oriented programming using C ++ and the GUI part of the QT library. Topics covered are classes and objects, inheritance, and polymorphism. We study all the basic concepts of GUI programming in the QT library.	7	KC3 KC4 KC6
EEC6006	Digital signal processing	The discipline studies basic methods and algorithms for digital signal processing and their computer modeling using the software package (MATLAB). The specifics of the representation of signals and digital signal processing systems in MATLAB are considered in detail. Linear discrete systems, the synthesis of digital filters and the modeling of these objects and processes using the MATLAB software are described.	6	
HRD6305	Applied robotics (IoT)	Modeling, creating and demonstrating complex multi-robotic systems, including sensing, computation and actuation. The industrial problems of the real world are considered. The student will design and build a mechanical subsystem with appropriate drives and sensors for computer control.	7	KC1-8
HRD6306	Robotics with artificial intelligence	The study of the basic methods in the field of artificial intelligence, including probabilistic inference, planning and search, localization, tracking and control, all with an emphasis on robotics.	7	KC3 KC4 KC6
RM6301	Research fundamentals	Studying the issues of practical organization of scientific research, analysis and generalization of research results, mastery of the theory of engineering decision making, the basics of project management, requirements analysis, architecture development, detailed design, development of user interfaces and testing methods.	4	KC2
SFT6324	Smart City Technologies	The course "Smart City Technologies" is designed for those who want to learn how modern technologies can be used to improve the urban environment and improve the quality of life of residents. The course will cover the basic concepts and principles of Smart City, as well as examples of	5	

		successful implemented projects in various countries. Students will explore various technologies such as IoT, wireless networks, Big Data, artificial intelligence, as well as energy management, transportation management, public safety improvement, and waste management technologies.		
LAN6003PA	Professionally oriented foreign language	Business English skills are taught. The formation and development of listening, speaking, reading and writing skills in English on topics related to professional activities, as well as the development of social skills such as presentations.	3	KC8
PP6302	Industrial practice	The consolidation of theoretical knowledge and the acquisition of practical skills in enterprises.	4	KC1-8
PP6303	Industrial practice	Systematization, consolidation and expansion of theoretical knowledge, development of practical skills, mastery of the elements of independent practical and research work in enterprises.	4	KC1-8
EGR6303	Project management	Learning the basics of project management and the necessary steps to ensure successful project management. Studying the main characteristics of project management and various roles in the project to ensure success. Application of key skills to the project to evaluate, plan and develop control mechanisms.	4	KC3 KC4 KC6 KC7
PP6304	Pre-diploma practice	Search for information for writing the diploma project	5	KC2
Elective courses (EC)				
ANL6301	Introduction to data science	A basic understanding of machine learning and statistics. Studying data science methodology, open source tools for data science, the basics of mathematical statistics needed for machine learning. Constructing and testing hypotheses. The use of simple predictive models.	6	KC3 KC4 KC6
SFT6329	Introduction to quantum computing	In the course, quantum computing will be considered more from the point of view of mathematics, rather than quantum physics, the main concepts on which quantum algorithms are built will be told, some existing quantum algorithms will be considered.		
EGR6301	Operating systems	Acquaintance with modern operating systems, their functionality and structure. Methods of process planning, interprocess communication, process synchronization, deadlock processing, main memory management during process execution, classical internal algorithms and storage management structures, and design of an input-output system are considered.	6	KC1 KC2 KC6
NET6310	Linux Operating System	The purpose of the discipline "Linux Operating System" is to teach students the basics of working and managing the Linux operating system. Upon completion of the course, students should have an understanding of the core concepts of Linux and be able to use it effectively in a variety of scenarios.		
MIN601	Minor 1	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	
MIN602	Minor 2	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	
SEC6301	Fundamentals of information security	It covers basic security concepts, principles and technologies, cryptography, attack methods and security monitoring. Studying basic security methods for searching for threats on the network using various popular security tools in a real network infrastructure.	4	KC3 KC4 KC6

NET6304	Cloud Computing and Virtualization	Introductory course from Linux Foundation experts. Learning the basics of cloud computing, terminology, tools and technologies associated with modern cloud platforms. The course displays the entire cloudy landscape and explains how various tools and platforms interact with each other.		
SFT6319	Blockchain technology	The Blockchain course is for those who want to learn more about blockchain technology and its applications. The course will look at how blockchain works, what its advantages and disadvantages are, what cryptocurrencies and tokens use blockchain, how to create and use smart contracts, and what are the examples of blockchain applications in various fields such as finance, logistics, medicine, etc. others	5	
SFT6321	QA testing	This course includes theoretical and practical classes on the following topics: main types of testing; basics and classification of testing; testing principles; WEB-product testing; software development methodology; test design techniques; work with Requirements for the tester; compiling and working with checklists in practice; compiling and working with test cases in practice; compiling and working with bug reports in practice; compiling and working with test sets; work in the JIRA system, etc.		
MIN603	Minor 3	Additional educational program (minor) - a set of disciplines and (or) modules and other types of educational work, determined by students for study in order to form additional competencies	5	

4.4 List of modules and learning outcomes

Module name	Total number of credits	Learning outcomes	Criteria for assessing learning outcomes	Module-forming disciplines
GENERAL EDUCATION MODULES				
General education module	10	The student has an idea of the principles and laws of the historical development of society, the historical periodization of the history of Kazakhstan, the place of the history of Kazakhstan in world history and the history of Eurasia, the place and role of philosophy in the life of society and man; the main stages of development of world and Kazakh philosophical thought.	Testing, oral interview, report, term paper, presentation, midterm.	History of Kazakhstan Philosophy
Social and political knowledge module	16	The student has an idea of socio-ethical values based on public opinion, traditions, customs, social norms and focuses on them in their professional activities; traditions and culture of the peoples of Kazakhstan; the rights and freedoms of man and citizen; the foundations of the legal system and legislation of Kazakhstan; social development trends in society; the basics of physical culture and the principles of a healthy lifestyle.	Testing, oral interview, report, term paper, presentation, midterm.	Political science Sociology Psychology Cultural studies Physical Culture
Language module	25	The student can freely express himself in writing and verbally, including professionally in the state language, the language of interethnic communication and English; knows how to logically correctly, reasonably and clearly build oral and written speech.	Testing, oral interview, term paper, presentation, midterm.	Foreign language Kazakh (Russian) language Business correspondence in the state language Professionally oriented foreign language
BASIC MODULES				
Basic module	9	The student is able to use modern ICT in professional activities, independently versatile and critically analyze modern sources, draw conclusions, argue them and make decisions based on information.	Testing, oral interview, report, term paper, presentation, laboratory work, midterm control.	Information and Communication Technologies Research fundamentals
Math module	24	The student is able to use basic mathematical tools to solve professional problems.	Testing, oral interview, course, laboratory, control work, midterm.	Algebra and geometry Mathematical analysis Discrete mathematics Probability theory and mathematical statistics Introduction to quantum computing
Hardware module	27	The student is able to analyze the structure of the main components of the computer, use a wide range of technologies of internal and external memory; write program code for manipulating bits in the processor.	Testing, oral interview, course, laboratory, control work, midterm.	Physics Basic Circuit Theory Design and simulation of electronic devices Fundamentals of Logic Design

PROFESSIONAL MODULES

Module		Competence	Assessment	Disciplines
				Introduction to data science
Programming module	42	The student is able to apply suitable data structures and develop appropriate algorithms to solve various computational problems. The student is able to use various tools for software development, user interface, storage and data processing systems.	Testing, oral interview, course, laboratory, control work, midterm.	Algorithmization and Programming; Object oriented programming; Blockchain technology; QA testing; Algorithms and Data Structures; Database Design. Introduction to SQL; Programming in Python language; Digital signal processing
Network and system administration module	35	The student is able to administer systems and networks of any configuration, troubleshoot and prevent threats.	Testing, oral interview, course, laboratory, control work, midterm.	Introduction to computer networks; Operating Systems; Fundamentals of information security; Linux Operating System; Cloud Computing and Virtualization; Minor 1; Minor 2
Robotics module	37	The student is able to develop, operate and maintain robotic systems.	Testing, oral interview, course, laboratory, control work, midterm.	Introduction to Robotics; Sensor Technologies; Applied Robotics (IoT); Smart City Technologies; Robotics with Artificial Intelligence; Minor 3
Project module	13	The student is able to use various software development methodologies, draw up program documentation using the required diagrams, develop models of the logical and physical architecture of the software system, database, and manage the development process.	Testing, oral interview, course, laboratory, control work, midterm.	Economics and organization of production; Project management; Software Architecture and Design

5 Curriculum of the educational program

Course 1

№	Code	Subject	Total credits	Total hours	STSH	SSH	Aud.	PS	L	Lab	SP	Study language	Result control	Credits sem 1	Credits sem 2
				Number of hours				Contact hours						Distribution of credits per semester	
		Core subjects													
1	LAN6001A	Foreign language	5	150	15	90	45	45				by student's option	exam.	5	
2	ICT6001	Information and Communication Technologies	5	150	15	90	45		15	30		by student's option	exam.	5	
3	LAN6002A	Foreign language	5	150	15	90	45	45				by student's option	exam.		5
4	PhC6005	Physical Culture	4	120	15	60	45	45				by student's option	exam.		4
		Catalogue of University disciplines													
5	MAT6001**	Algebra and Geometry	4	120	15	60	45	30	15			by student's option	exam.	4	
6	SFT6301	Algorithmization and Programming	6	180	15	105	60	15	15	30		by student's option	exam.	6	
7	NET6301	Introduction to computer networks	5	150	15	90	45		15	30		by student's option	exam.	5	
8	PHY6001	Physics	7	210	15	120	75	30	15	30		by student's option	exam.		7
9	MAT6002	Mathematical analysis	6	180	15	105	60	15	15	30		by student's option	exam.		6
10	PP6301	Educational practice	2	60			60				60	by student's option	pract		2
11	HRD6301	Introduction to Robotics	6	180	15	105	60	15	15	30		by student's option	exam.		6
12	SFT6305	Database Design. Introduction to SQL	5	150	15	90	45		15	30		by student's option	exam.		5
		Total	60	1800	165	1005	630	240	120	210	60	.		25.0	35.0
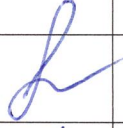
Course 2				Number of hours				Contact hours				Study language	Result control	Distribution of credits per semester	
№	Code	Subject	Total credits	Total hours	STSH	SSH	Aud.	PS	L	Lab	SP			1	2
		Core subjects													
1	LAN6001KR	Kazakh (Russian) language	5	150	15	90	45	45				by student's option	exam.	5	
2	PhC6006	Physical Culture	4	120	15	60	45	45				by student's option	exam.	4	
3	SPS6001	Philosophy	5	150	15	90	45	30	15			by student's option	exam.		5
4	LAN6002KR	Kazakh (Russian) language	5	150	15	90	45	45				by student's option	exam.		5
5	HK6002	History of Kazakhstan	5	150	15	90	45	30	15			by student's option	q. exam		5
		Catalogue of University disciplines													
6	MAT6005	Discrete mathematics	4	120	15	60	45		15	30		by student's option	exam.	4	
7	SFT6302	Algorithms and Data Structures	4	120	15	60	45		15	30		by student's option	exam.	4	
8	EEC6001	Basic Circuit Theory	4	120	15	60	45		15	30		by student's option	exam.	4	
9	SFT6306	Software Architecture and Design	4	120	15	60	45		15	30		by student's option	exam.	4	
10	SFT6304	Programming in Python language	4	120	15	60	45		15	30		by student's option	exam.	4	
11	MAT6006	Probability theory and mathematical statistics	4	120	15	60	45	30	15			by student's option	exam.		4
12	EEC6004	Fundamentals of Logic Design	5	150	15	90	45		15	30		by student's option	exam.		5
13	LAN6003PA	Professionally oriented foreign language	3	90	15	45	30	30	15			by student's option	exam.	3	
14	PP6302	Industrial practice	4	120			120				120	by student's option	pract.		4
		Qualification examination													
15			4												5
		Total	60	1800	195	915	690	255	135	180	120			32.0	28.0

Course 3

№	Code	Subject	Total credits	Total hours	STSH	SSH	Aud.	PS	L	Lab	SP	Study language	Result control	Sem 1	Sem 2
		Core subjects													
1	SPS6005	Psychology	2	60	15	15	30	15	15			by stud's option	exam.	2	
2	SPS6004	Cultural studies	2	60	15	15	30	15	15			by stud's option	exam.	2	
3	SPS6003	Political science	2	60	15	15	30	15	15			by stud's option	exam.		2
4	SPS 6002	Sociology	2	60	15	15	30	15	15			by stud's option	exam.		2
		Catalogue of University disciplines													
5	ECO6002	Economics and organization of production	5	150	15	90	45		15	30		by stud's option	exam.		5
6	SFT6002	Object oriented programming	7	210	15	120	75	30	15	30		by stud's option	exam.	7	
7	LAN6007K	Business correspondence in the state language	2	60	15	15	30	30				by stud's option	exam.	2	
8	EEC6003	Design and simulation of electronic devices	5	150	15	90	45		15	30		by stud's option	exam.	5	
9	HRD6304	Sensor Technologies	7	210	15	120	75	30	15	30		by stud's option	exam.	7	
10	PP6303	Industrial practice	4	120			120				120	by stud's option	pract.		4
		Electives													
11	ANL6301	Introduction to data science	6	180	15	105	60	15	15	30		by stud's option	exam.		6
12	SFT6329	Introduction to quantum computing	6	180	15	105	60	15	15	30		by stud's option	exam.		6
13	EGR6301	Operating Systems	6	180	15	105	60	15	15	30		by stud's option	exam.		6
14	NET6310	Linux Operating System		180	15	105	60	15	15	30		by stud's option	exam.		6
15	MIN601	Minor 1	5	150	15	75	60	15	15	30		by stud's option	exam.	5	
16	MIN602	Minor 2	5	150	15	75	60	15	15	30		by stud's option	exam.		5
		Total	60	2160	225	1065	870	240	210	300	120			30.0	30.0

Course 4

№	Code	Subject	Total credits	Total hours	STSH	SSH	Aud.	PS	PS	PS	PS	Study language	Result control	1	2
		Catalogue of University disciplines													
1	RM6301	Research fundamentals	4	120	15	60	45	30	15			by student's option	exam.	4	
2	EEC6006	Digital signal processing	6	180	15	105	60	15	15	30		by student's option	exam.	6	
3	HRD6305	Applied Robotics (IoT)	7	210	15	120	75	30	15	30		by student's option	exam.	7	
4	HRD6306	Robotics with Artificial Intelligence	7	210	15	120	75	30	15	30		by student's option	exam.	7	
5	SFT6324	Smart City Technologies	5	150	15	75	60	15	15	30		by student's option	exam.	5	
6	EGR6303	Project management	4	120	15	60	45		15	30		by student's option	exam.		4
7	PP6304	Pre-diploma practice	5	150			150				150	by student's option	pract.		5
		Electives													
8	SEC6301	Fundamentals of information security	4	120	15	60	45		15	30		by student's option	exam.	4	
9	NET6304	Cloud Computing and Virtualization		120	15	60	45		15	30		by student's option	exam.	4	
10	SFT6319	Blockchain technology	5	150	15	90	45		15	30		by student's option	exam.	5	
11	SFT6321	QA testing		150	15	90	45		15	30		by student's option	exam.		
12	MIN603	Minor 3	5	150	15	75	60	15	15	30		by student's option	exam.	5	
		Qualification examination													
13		Diploma thesis/project													8
		Total	60	1830	165	915	750	135·	165	300	150		·	43.0	17.0

F-72, Образовательная программа

6 Developer approval sheet

The title of the educational program: 6B06107 «Cyberphysical Systems»

№ п/п	Position, degree, last name and initials of a developer of the educational program	Date	Signature	Note
1	PhD, head of the «CE» department, ass professor T.T. Chinubayeva	15.03.2023		
2	MSc, senior-lector of the «CE» department Tokanov O.S.	15.03.2023		