AGREED
Executive director of
«Internet Society Kazakhstan» PO
Nurlybayev T.A.
«__» _____ 2023

APPROVED
Rector
of JSC «International Information
Technology University»
Hikmetov A.U.
«30» _____ 2023

EDUCATIONAL PROGRAM

7M06110 Computer Systems and Software Engineering

Code and classification of the field of education: 7M06 – Information and Communication Technology

Code and classification of training area: 7M061 – Information and Communication Technology

Group of educational programs: M094 – Information Technology

ISCED level: 7

NQR level: 7

ORC level: 7

Duration: 2 years

Number of credits: 120

AGREED
Director of
«KnewIT Programming School» LLC
Bekaulov N.M.
«__» _____ 2023

AGREED
Executive director of
«KazREENA Association» ALE
Tatybayev S.K.
«__» _____ 2023

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 educational program 7M06110 «Computer Systems and Software Engineering» is designed to implement the principles of democratic education management, expanding the boundaries of academic freedom and the powers of educational institutions, which will ensure the adaptation of the system of technical and vocational education to the changing needs of society, the economy of the labor market. The flexibility of the program will take into account the abilities and needs of the individual, production and society.

The educational program is developed taking into account the needs of the labor market in the field of information and communication technologies. This educational program ensures the application of an individual approach to students, ensures the transformation of professional competencies from professional and qualification standards into learning outcomes. Student-centered learning is provided. This principle of education implies a shift in emphasis in the educational process from teaching to learning.

The fields of professional activities of graduates are higher educational institutions, research institutions, production of software development for information and computing systems for various purposes, software companies, IT departments of industrial enterprises, design organizations, public and private enterprises and organizations that develop, implement and use computer hardware and software in various fields, in other words almost all spheres of human activity.

2 The goal and objectives of the educational program

The goal of the EP is to train researchers and managers in the field of software development, highly qualified developers and architects of software systems with competencies in the field of data analysis for the IT industry of the Republic of Kazakhstan.

The objectives of the EP to:

1. Deepen the theoretical knowledge and practical skills of undergraduates in the areas of training.
2. Teach the implementation of research projects related to objects of professional activity, and the analysis of existing concepts, theories and approaches to software development.
3. Teach graduate students to apply the obtained theoretical and practical knowledge in solving various problems arising in the process of their professional activity.
4. Instill in graduate students the skills to independently, constantly acquire, develop and apply professional knowledge and skills for solving non-standard tasks (interdisciplinary, etc.).
5. Train researchers in the field of software development for various fields of human activity.
6. Teach undergraduates to apply the knowledge of pedagogy and psychology of higher education in their teaching activities.
7. Teach a generalization of the results of research work in the form of a dissertation, a scientific article, a report at conferences, a report, an analytical note, etc.

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

After the completion of the educational program a postgraduate student must be able to:

- Formulate and solve problems arising in the course of scientific research and requiring in-depth advanced professional knowledge.
- Choose the necessary research approaches and methods, modify existing ones and develop new ones based on the objectives of a specific study, as well as for solving problems in a new environment, in a broader interdisciplinary context.
- Apply methodological knowledge in the process of conducting scientific research, pedagogical and educational work. Demonstrate the skills necessary to independently continue further education.
- Apply psychological methods and means to increase the effectiveness and quality of teaching in pedagogical activity.
- Apply quantitative methods and techniques to develop effective solutions to production problems taking into account social, ethical and scientific considerations.
- Analyze software within the scope of production activities.
- Design and develop software systems for solving applied problems in the framework of production activities.
- Manage the team in the software development process.
- Use advanced technologies to organize effective data storage and management; apply data analysis methods to solve various problems.
- Know the methods of scientific research and academic writing, understand the meaning of the principles and culture of academic integrity; be able to clearly and unambiguously communicate information, ideas, conclusions to both specialists and non-specialists.

4 Passport of the educational program

4.1 General information

№	Field name	Note
1	Code and classification of the field of education	7M06 – Information and Communication Technology
2	Code and classification of training areas	7M061 – Information and Communication Technology
3	Group of educational programs	M094 – Information Technology
4	Name of the educational program	Computer Systems and Software Engineering
5	Type of EP	Acting EP
6	Purpose of EP	Training of researchers in the field of software engineering, managers in the field of software development, highly qualified developers of software and information systems and architects of software systems for the IT industry of the Republic of Kazakhstan.
7	ISCED level	7th level
8	NQF level	7th level
9	IQF level	7th level
10	Distinctive features of EP	No
	Partner university (SOP)	
	Partner university (PDD)	
11	List of competencies	PC1: The ability to use the acquired knowledge for the original development and application of ideas in the context of scientific research. PC2: The ability to apply the acquired knowledge in their professional activities to solve production problems. PC3: The ability to independently, constantly acquire,

		develop and apply professional knowledge and skills. PC4: The ability to apply the knowledge of pedagogy and psychology of higher education in pedagogical activities. PC5: The ability to select and develop methods for analyzing objects of professional activity based on general ICT development trends. PC6: The ability to conduct analysis to solve complex software (technical) problems and ensure the implementation of the most optimal solutions. PC7: The ability to apply advanced technologies for the development of software products within the professional direction, as well as to lead the development process. PC8: The ability to improve software products to increase their competitiveness and effectiveness at all stages of the life cycle. PC9: The ability to summarize the results of research and analytical work in the form of a dissertation, a scientific article, a report at scientific and technical conferences, a report, an analytical note, etc.
12	Learning outcomes	LO1: Formulate and solve problems arising in the course of scientific research and requiring in-depth advanced professional knowledge. LO2: Choose the necessary research approaches and methods, modify existing ones and develop new ones based on the objectives of a specific study, as well as for solving problems in a new environment, in a broader interdisciplinary context. LO3: Apply methodological knowledge in the process of conducting scientific research, pedagogical and educational work. Demonstrate the skills necessary to independently continue further education. LO4: Apply psychological methods and means to increase the effectiveness and quality of teaching in pedagogical activity. LO5: Apply quantitative methods and techniques to develop effective solutions to production problems taking into account social, ethical and scientific considerations. LO6: Analyze software within the scope of production activities. LO7: Design and develop software systems for solving applied problems in the framework of production activities. LO8: Manage the team in the software development process. LO9: Use advanced technologies to organize effective data storage and management; apply data analysis methods to solve various problems. LO10: Know the methods of scientific research and academic writing, understand the meaning of the principles and culture of academic integrity; be able to clearly and unambiguously communicate information, ideas, conclusions to both specialists and non-specialists.

13	Form of study	Full-time
14	Language of instruction	English
15	Number of credits	120 ECTS credits
16	Awarded academic degree	Master
17	Availability of application to the license for the direction of training	License number 0064060, date of application issue 19th of March, 2019
18	Accreditation of EP	Yes
	Name of accreditation body	ASIIN, Germany, https://www.asiin.de/en/
	Duration of accreditation	07.12.2018- 30.09.2024
19	Information about the courses	1 Basic disciplines (BD) – 35 credits 1.1 University component – 20 credits 1.2 Electives – 15 credits 2 Profession disciplines (PD) – 53 credits 2.1 University component – 22 credits 2.2 Electives – 20 credits 2.3 Research practice – 11 credits 3. Masters research work, including internships and master dissertations – 24 credits 4. Final attestation – 8 credits
20	Professional Standard for EP	Development of geoinformation systems, Software development, Software developers and specialists for testing of WEB and multimedia applications, Software testing, Administration, management and diagnostics of computer networks and network infrastructure, Database administration, Development of artificial intelligence applications, Development of IoT systems
21	Atlas of new professions	Architect peripheral computing, R&d manager, Development engineer artificial neural network, Blockchain -technologist
22	Regional standard	Not provided

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

	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10
PC1	V	V	V							
PC2					V					
PC3			V							
PC4			V	V						
PC5						V			V	
PC6					V	V				
PC7							V	V	V	
PC8							V			V
PC9	V									

4.3 Information about courses

№	Name of the course	Short description of the course (30-50 words)	Number of credits	Formed competencies (codes)
		Basic disciplines University component		
1.	History and philosophy of science	The purpose of the discipline is to form the skills of working with scientific literature; logical, systemic, and critical thinking skills. The discipline will study: the main stages of the development of science; history and philosophy of science to form a conscious attitude to the environment and history, the basic principles of research activities.	4	PC1, 3 LO3
2.	Foreign language (professional)	English Language is a compulsory component of the program offered to the 1st-year IITU Master's students. It is a one-semester practical course that tailors the English language program to the Master's students' professional/research needs. During the course the Master's students will work on an individual project and a research portfolio. By the end of the course, students will organize and present research portfolio.	4	PC1, 2, 3 LO3
3.	High School of Pedagogy	The objectives of mastering the discipline "Higher education pedagogy" are - provide knowledge about educational management process for teaching in higher education, to give an idea of the main categories of pedagogy, about the place, role and significance of pedagogy higher education in the system of human sciences and in practical activity teacher, to form an understanding of the basic principles of modern pedagogy and methodological approaches to solving pedagogical problems high school.	4	PC3, 4 LO3, LO4
4.	Psychology of management	The purpose of the course is a fundamental study of modern interpretations of the subject and the main categories of psychological science; work with psychological mechanisms of management and the laws of interpersonal interaction in the conditions of professional activity; substantiation of the relevance of psychological knowledge in solving practical issues in human life; development of systemic, creative thinking of the future specialist, research culture and the need for continuous self-education and self-development.	4	PC3, 4 LO3, LO4
5.	Teaching practice	Teaching practice is a type of practical activity of undergraduates, including the teaching of special disciplines, the organization of educational activities of students, scientific and methodological work on the subject, obtaining skills in the work of a teacher.	4	PC3, 4 LO3
		Basic disciplines Electives		
6.	Operations research and optimization techniques	Research and practical application of the methods of the most effective (or optimal) control. Operations research is focused on solving practical problems that can be described using mathematical models. The main sections of the theory of operations research are presented: mathematical programming (linear and nonlinear, deterministic and stochastic), game theory, inventory control theory, queuing theory, simulation modeling.	5	PC5 LO5, LO10
7.	Decision theory	The formation of fundamental knowledge about the principles of application of mathematical models, methods and algorithms for the selection of effective solutions for solving various problems. The formation of comprehensive knowledge and practical skills in structuring, analyzing and solving problems. The development by graduate students of skills in the qualified use of the mathematical apparatus and	5	PC5 LO5, LO10

		application software packages for solving decision-making problems.		
8.	Cloud computing and virtualization	Learning the basics of cloud computing. The terminology, tools and technologies associated with modern cloud platforms are discussed. The course displays the entire cloudy landscape and explains how the various tools and platforms fit together.	5	PC6, 7 LO6
Profession disciplines University component				
9.	Research methodology	The study of types of scientific research, the methodology of scientific knowledge, research, the formation of conclusions and conclusions, writing scientific articles and reports at the conference, summarizing the results of research work in a dissertation, its structure and content.	4	PCK1, 9 LO1, LO2
10.	Advanced Web-technologies	The course covers concepts, technologies and methods for creating a large-scale distributed software system using service-oriented computing and cloud applications. In-depth study of advanced technologies focused on web standards, interactivity and design.	5	PC7, 8 LO7
11.	Advanced databases	It covers advanced topics in database theory, such as data mining, data warehousing, distributed databases, client-server architecture. The methods of data storage and presentation, query processing and optimization, transaction processing, parallelism, improved data models for modern applications, temporary, deductive and extended databases, databases for decision support systems are considered.	5	PC7, 8 LO7, LO9
12.	Project management in IT	Familiarization of undergraduates with the theoretical and practical foundations of project management in the field of information technology, as well as development teams, development of practical skills in preparing and managing projects, training in the ability to communicate with the team to achieve productive activities.	5	PC7 LO8
13.	Theory and Technology of Blockchain	The course examines the main technical aspects of Blockchain technology, principles of operation, possible applications and development prospects	4	PC6, 7, 8 LO6, LO7
Profession disciplines Electives				
14.	Natural language processing	The basics of automatic processing of texts written in a natural language are considered. It is supposed to use ready-made applications for linguistic analysis, consider the principles of their work, as well as familiarity with the basic mathematical models that underlie modern computer linguistics.	5	PC6, 7, 8 LO6, LO7, LO10
	Machine learning and computer statistics	The course includes topics such as supervised learning (linear learning models, neural networks, reference vector machines); teaching without a teacher (clustering, reduction of dimension); learning theory (CV theory; large fields). It discusses modern areas of application of machine learning, such as robotic control, data mining, autonomous navigation, speech recognition, as well as text and web data processing.		PC6, 7, 8 LO6, LO7, LO10
	Implementation and Operation of Basic Enterprise Network Technologies	The course is aimed at obtaining undergraduate knowledge and the acquisition of the skills necessary to configure, troubleshoot and manage wired and wireless networks of the enterprise. The course also discusses the principles of security in the enterprise network.		PC6, 7, 8 PO6, PO7
15.	Computer vision	Introduction to computer vision, image and video analysis for the recognition, reconstruction and modeling of objects in a three-dimensional world. The basics of image formation, camera image geometry, detection and comparison of characteristics, image classification, deep learning using neural networks are considered.	5	PC6, 7, 8 LO6, LO7, LO10
	Geographic Information	The course introduces students to the basic ways of organizing, storing and modeling spatial data. The content of		PC6, 7, 8

	Systems	the discipline also covers a range of issues related to automated mapping and the use of geoinformation technologies in making management decisions.		LO6, LO7
	Implementing Cisco Enterprise Advanced Routing and Services	The course is aimed at obtaining undergraduates knowledge and the acquisition of the skills necessary for installing, configuring, operating and troubleshooting a corporate network. The course addresses advanced routing technologies and infrastructure.		PC6, 7, 8 LO6, LO7
16.	IoT and artificial intelligence	The aim of this course is to teach undergraduates advanced artificial intelligence methods that can be useful for industrial automation, environmental assessment, as well as for human-computer interaction, etc.	5	PC6, 7, 8 LO6, LO7
	Effective communication	To form the basic knowledge, skills and practical skills of using modern communication strategies as a mechanism for building communication links between society and the subjects of the political and economic process. To master and test the techniques of interaction and influence that allow you to adequately respond to the situation, communicate freely and effectively, effectively interact with people, use different behaviors, holistically understand your own and common interests, set priorities and make choices.		PC1, 2 LO3, LO4, LO8
	Enterprise Linux in Corporate Networks	The course aims to study the administration of the Linux operating system. Attention is focused on the fundamental concepts of Linux and its main tasks. It discusses the application of the command line concept and enterprise level tools.		PC6, 7, 8 LO6, LO7
17.	Web data analysis	Studying web data mining methods for solving various problems of analytical processing, creating models for analyzing structured and semi-structured web data.	5	PC6, 7, 8 LO6, LO7
	Public speaking	"The art of public speaking is understood as a set of knowledge and skills of a speaker in the preparation and delivery of a public speech: - ability to select material, the art of constructing speech in order to have a certain impact on the audience; - the ability to prove and refute, the ability to convince; - speech skills. This course examines the purpose and characteristic features of public speech, methods and methods of argumentation, speech means of logic and impact of speech, ethics of speech behavior of the speaker. Recommendations on the choice and use of language tools and the prevention of speech errors, exercises for the development of voice and correct intonation are given. The course is supported by an extended laboratory workshop"		PC1, 2 LO3, LO4, LO8
	Corporate Networks Design	The course is aimed at gaining knowledge and acquiring skills necessary for designing a corporate network, including modern solutions for addressing and routing. It covers concepts such as modern corporate networks, WANs, security services, network services, and SDA with software access.		PC6, 7, 8 LO6, LO7
	Research practice	Acquaintance with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data.	11	

5 Curriculum of the educational program

Code of the discipline	Name of the discipline	Total					including							Credits distribution by year and semester			
							including				Self-study			number of weeks			
		Total credits	Semester	Grading	Course project (work)	Total hours	Auditory	Lectures	Practical	Laboratory	Total	With teacher	Self-study (not in auditory)	15	15	15	15
														2020-2021		2021-2022	
														1	2	3	4
	I. Theoretical study																
	1. Basic disciplines (BD)																
	1) University component (UC)																
SPS7003	Psychology of management	4	1	экз		120	30	15	15		90	15	75	4			
LAN7001A	Foreign language (professional)	4	1	экз		120	30		30		90	15	75	4			
SPS7001	History and philosophy of science	4	2	экз		120	30	15	15		90	15	75		4		
SPS7002	High School of Pedagogy	4	2	экз		120	30	15	15		90	15	75		4		
PP7301	Teaching practice	4	3			120					120	30	90			4	
	Total BD UC	**20**	1			**600**	**120**				**480**						
	2) Elective courses (EC)																
SFT7309	Cloud Computing and Virtualization	5	1			150	45	15	30		105	15	90	5			
ANL7301	Operations Research and Optimization Techniques	5	1			150	45	15	30		105	15	90	5			
ANL7302	Decision Theory	5	3			150	45	15	30		105	15	90			5	
	Total BD EC	**15**				**450**	**45**				**105**						
	Total BD UC, EC	**35**				**1050**	**165**				**585**						
	2. Profession disciplines (PD)																
	1) University component (UC)																

SFT7311	Theory and Technology of Blockchain	4	1			120	30	15	15		90	15	75	4			
RM7301	Research Methodology	4	2			120	30	15	15		90	15	75		4		
SFT7301	Advanced Web-technologies	5	2			150	45	15	30		105	15	90		5		
SFT7302	Advanced Databases	4	2			120	30	15	15		90	15	75		4		
SFT7310	Project Management in IT	5	3			150	45	15	30		105	15	90			5	
	Total PD UC	**22**				**660**	**180**				**480**						
	2) Elective courses (EC)																
	Elective course 1	5	1			150	45	15	30		105	15	90	5			
ANL7306	Computer Vision																
SFT7307	Geographic Information Systems																
NET7302	Implementing Cisco Enterprise Advanced Routing and Services																
	Elective course 2	5	2			150	45	15	30		105	15	90		5		
ANL7305	Machine Learning and Computer Statistics																
NET7301	Implementation and Operation of Basic Enterprise Network Technologies																
ANL7304	Natural Language Processing																
	Elective course 3	5	3			150	45	15	30		105	15	90			5	
ANL7307	Web Data Analysis																
NET7304	Corporate Networks Design																
JUR7002	Public Speaking																
	Elective course 4	5	3			150	45	15	30		105	15	90			5	
SFT7308	IoT and Artificial Intelligence																
NET7303	Enterprise Linux in Corporate Networks																
JUR7001	Effective Communication																
	Total PD EC	**20**				**600**	**180**				**420**						
	3) Research practice																
PP7302	Research practice	5	2			150					150	15	135		5		

PP7303	Research practice	6	3			180					180	15	165				6
	Total PD RP	**11**				**330**					**330**						
	Total PD UC, EC, RP	**53**				**1590**	**360**				**1230**						
	II. Research work																
RW7000	Master's research work, including internship and master's thesis (NIRM)	2	1			60					60	15	45	2			
RW7001	Master's research work, including internship and master's thesis (NIRM)	3	2			90					90	15	75		3		
RW7002	Master's research work, including internship and master's thesis (NIRM)	5	3			150					150	30	120			5	
RW7003	Master's research work, including internship and master's thesis (NIRM)	14	4			420					420	90	330				14
	Total NIRM	**24**				**720**					**720**						
	Final State Attestation																
	Design and defense of a master's thesis	8	4			240					240	45	195				8
	Total Final State Attestation	**8**				**240**					**240**						
	Total	**120**				3600	525				2775			29	34	29	28

6 Developer approval sheet

The title of the educational program: 7M06110 «Computer Systems and Software Engineering»

№ п/п	Position, degree, last name and initials of a developer of the educational program	Date	Signature	Note
1	PhD, associate professor of the «CE» department N.T. Duzbayev	30.03.2023		
2	Cand. of tech. sc., associate professor of the «CE» department M.T. Ipalakova	30.03.2023		
3	MSc, senior lecturer of the «CE» department L.A. Kozina	30.03.2023		