

AGREED
Chairman of the Educational and
Methodological Department
Council of JSC «International Information
Technology University»
Mustafina A.K.
«19» 03 2024

APPROVED
Chairman of the Board-Rector
of JSC «International Information
Technology University»
Hikmetov A.U.
03 2024

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
Bekbaev N.M.
2024

AGREED
Director of
«ProTechSolutions» LLC
Rakhmankulov Z.M.
2024

Almaty, 2024

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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	7 th level
8	NQF level	7 th level
9	IQF level	7 th level
10	Distinctive features of EP	No
	Partner university (SOP)	
	Partner university (PDD)	
11	Qualification characteristics of a graduate of the educational program:	Field of professional activity of the graduate of the EP: The field of professional activity of the EP “7M06110 - Computer technology and software” is mathematical,

		information, software, linguistic, technical and organizational and legal support of information systems, including technologies for design, development, implementation, maintenance and operation. Objects of professional activity of graduates of the EP: Objects of professional activity of graduates of the EP “7M06110 - Computer technology and software” are computers, complexes, systems and networks; - computer systems for information processing and management; - computer-aided design systems; - software for computer technology and information systems. Subject of professional activity of graduates of the EP: The subject of professional activity of graduates of the EP “7M06110 - Computer technology and software” is mathematical, information, software, linguistic, technical and organizational and legal support of information systems, including technologies for design, development, implementation, maintenance and operation . Types of professional activities of EP graduates: - operation of all types of computer systems; - design and engineering; - production and technological; - experimental research; - organizational and managerial. Functions of professional activity of EP graduates: design and engineering activities: - development and execution of design and working technical documentation; - monitoring the compliance of developed projects and technical documentation with standards, technical specifications and other regulatory documents; - design and technological activities: the use of Web technologies in the implementation of remote access in client/server systems and distributed computing; - production and technological activities: creation of components of computer information processing and management systems, production of programs and software systems of a given quality; testing and debugging of hardware and software systems; - organizational and managerial activities: organization of workplaces, their technical equipment, placement of computer equipment; selection of technology, software tools and computer equipment when organizing the process of development and research of objects of professional activity; - research activities, innovation activities; installation and commissioning activities: - installation, debugging and configuration of technical means for putting software into operation; operation of software and their components.
12	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.
13	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.
14	Form of study	Full-time
15	Language of instruction	English
16	Number of credits	120 ECTS credits
17	Awarded academic degree	Master
18	Availability of application to the license for the direction of training	License number 0064060, date of application issue 19 th of March, 2019
19	Accreditation of EP	Yes
	Name of accreditation body	ASIIN, Germany, https://www.asiin.de/en/
	Duration of accreditation	07.12.2018- 30.09.2024
20	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 – 24 credits 2.2 Electives – 21 credits 2.3 Research practice – 8 credits 3. Masters research work, including internships and master dissertations – 24 credits 4. Final attestation – 8 credits
21	Professional Standard for EP	Development of geoinformation systems, Software testing, Development of artificial intelligence applications, Development of IoT systems, Testing of multimedia applications (including computer games), Cloud technology development, Development of big data processing and storage systems, Software maintenance
22	EP's strategic partners	“KnewIT Programming School” LLP, “ProTechSolutions” LLP
23	Developer(s) and authors of the Educational Program	JSC "International University of Information Technologies", Department of Computer Engineering: - Chinibaeva T. T., PhD, assistant professor - Sapakova S.Z., Ph.D., associate. Professor - Mamanova S.E., Senior-Lecturer
24	Atlas of new professions	Architect peripheral computing, R&d manager, Development engineer artificial neural network, Blockchain -technologist
25	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)	Prerequisite site	Postrequisite
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	no	no
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	no	no
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	no	Teaching practice
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	Psychology	no
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	High School of Pedagogy	no
Basic disciplines						
Electives						

6.	Algorithms in graph theory	Learning the basics of cloud computing. The terminology, The basics of graph theory are studied. Covers terminology, tools, and technologies related to graphs. The main types of objects and structures studied by graph theory are considered.	5	PC6, 5 LO5	Algorithmization and programming	Machine learning and computer statistics
7.	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.	6	PC7 LO8	no	no
8.	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	Information Security Basics	no
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.	5	PCK1, 9 LO1, LO2	no	Master's dissertation
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	Web Development Basics	no
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.	4	PC7, 8 LO7	Introduction to SQL	no
12.	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	Basics of linear algebra	no
13.	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.	5	PC6,7,8 LO6, LO7, LO10	Algorithms in graph theory	no
Profession disciplines						
Electives						
14.	Generative-adversarial networks	This discipline is devoted to the latest methods of generative adversarial networks, and their use for creating realistic images and three-dimensional structures. Upon mastering the discipline, students should know: the concept and organization of the	5	PC6, 7, 8 LO6, LO7, LO10	Machine learning	no

		generative model; concept and organization of the discriminative model; be able to: train generative adversarial networks and generate images with their help, ranging from basic handwritten numbers to restoration, correction, coloring of photographs; generate 3D.				
	Markov chains and decision-making processes	This discipline involves the study of Markov chains, in which each element is completely determined by the previous one. These circuits are widely used in setting problems of linking artificial intelligence to the behavior of an agent in a certain environment, for example, a robot in a real environment, on which, for example, reinforcement learning is based.		PC6, 7, 8 LO6, LO7, LO10	Introduction to AI	no
	Mathematics for computational sciences	This course covers an introduction to the mathematical courses necessary for the development of specialized disciplines of computer science, based on numerical solutions of deterministic and probabilistic equations of mathematical physics and applied models used in technical production and the financial sector, namely, the theory of ordinary differential equations, their typification and basic methods analytical solution and an introduction to partial differential equations.		PC6, 7, 8 PO6, PO7	Mathematical analysis	no
15.	Queuing theory	Formation of skills in mathematical modeling of service processes and the ability to evaluate the quality of service management using mathematical methods. Knowledge of elements of probability theory and the theory of random processes used in the study of queuing systems.	6	PC6, 7, 8 LO6, LO7, LO10	Probability theory	no
	Geographic Information Systems	The course introduces students to the basic ways of organizing, storing and modeling spatial data. The content of the discipline also covers a range of issues related to automated mapping and the use of geoinformation technologies in making management decisions.		PC6, 7, 8 LO6, LO7	Machine learning	no
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	OOP	no
	Federated Computing	The course aims to develop an understanding of the fundamental principles of federated computing, including secure data transfer and inter-device orchestration. Also mastering programming skills to implement federated algorithms. This may include the use of special libraries and frameworks.		PC6, 7, 8 LO6, LO7	Parallel Computing	no
	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	Operation system	no
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	Data Analysis Methods	no
	Quantum computing	The course is aimed at master's students obtaining knowledge and acquiring skills, developing students' theoretical knowledge of the basic concepts and methods of the theory of quantum computing.		PC6, 7, 8 LO6, LO10	Linear algebra	no
	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		PC6, 7, 8 LO6, LO7	Computer networks	no

		corporate networks, WANs, security services, network services, and SDA with software access.				
	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

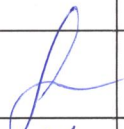
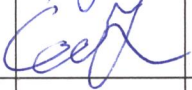
Code of the discipline	Name of the discipline	Total					including					Credits distribution by year and semester					
		Total credits	Semester	Grading	Course project (work)	Total hours	including				Self-study			number of weeks			
							Auditory	Lectures	Practical	Laboratory	Total	With teacher	Self-study (not in auditory)	15			
														15	15	15	15
	I. Theoretical study																
	1. Basic disciplines (BD)																
	1) University component (UC)																
SPS7003	Psychology of management	4	1	ЭК3		120	30	15	15		90	15	75	4			
LAN7001A	Foreign language (professional)	4	1	ЭК3		120	30		30		90	15	75	4			
SPS7001	History and philosophy of science	4	2	ЭК3		120	30	15	15		90	15	75	4			
SPS7002	High School of Pedagogy	4	2	ЭК3		120	30	15	15		90	15	75	4			
PP7301	Teaching practice	4	3			120					120	30	90			4	
	Total BD UC	20				600	120				480						
	2) Elective courses (EC)																
SFT7315	Algorithms in graph theory	5	1			150	45	15	15	15	105	15	90	5			
SFT7311	Theory and Technology of Blockchain	4	1			120	30	15	15		90	15	75	4			
SFT7310	Project Management in IT	5	3			180	60	15	30	15	105	15	105			6	
	Total BD EC	15				720	210				510						
	Total BD UC, EC	35				1320	330				990						
	2. Profession disciplines (PD)																
	1) University component (UC)																

RM7301	Research Methodology	5	2				150	45	15	15	15	90	15	90	5		
SFT7301	Advanced Web-technologies	5	2				150	45	15	15	15	105	15	90	5		
SFT7302	Advanced Databases	4	2				120	30	15	15	15	90	15	75	4		
ANL7301	Operations Research and Optimization Techniques	5	1				150	45	15	15	15	105	15	90	5		
ANL7305	Machine Learning and Computer Statistics	5	3				150	45	15	15	15	105	15	90		5	
	Total PD UC	24					450	135				315					
	2) Elective courses (EC)																
	Elective course 1	6	1				180	60	15	15	30	120	15	105	6		
SFT7307	Geographic Information Systems																
ANL7308	Theory of mass service																
	Elective course 2	5	2				150	45	15	30		105	15	90	5		
ANL7311	Generative-adversarial networks																
ANL7312	Markov chains and decision-making processes																
ANL7313	Mathematics for computational sciences																
	Elective course 3	5	3				150	45	15	30		105	15	90		5	
ANL7307	Web Data Analysis																
NET7304	Corporate Networks Design																
ANL7314	Quantum computing																
	Elective course 4	5	3				150	45	15	30		105	15	90		5	
SFT7308	IoT and Artificial Intelligence																
NET7303	Enterprise Linux in Corporate Networks																
SFT7314	Federated Computing																
	Total PDE EC	21					630	195				435					
	3) Research practice																
PP7302	Research practice	8	4				240						45	195		8	
	Total PD RP	8					240					240					

[illegible]

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, assistant professor of the «CE» department T. T. Chinibayeva			
2	Cand. of ph.-m. sc., associate professor of the «CE» department S.Z. Sapakova			
3	MSc, senior lecturer of the «CE» department S.E. Mamanova			