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

APPROVED
Acting rector
of JSC «International Information
Technology University»
_____ Hikmetov A.U.
«20» 03 2023

EDUCATIONAL PROGRAM

7M06101 «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
_____ Bekdauov N.M.
«___» _____ 2023

AGREED
Executive director of
«KAZRENA Association» ALE
_____ Tavybayev 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 7M06101 «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 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.

The objectives of the EP to:

1. To train researchers in the field of software development.
2. To teach the conduct of scientific research related to the objects of professional activity, and the analysis of existing concepts, theories and approaches to the development of programs and the creation of corporate information systems.
3. To develop the ability of graduate students to develop new and improve existing methods and algorithms for data processing in information and computer systems.
4. To teach graduate students to apply the obtained theoretical and practical knowledge in solving practical problems in the field of ICT, to successfully carry out managerial and research activities.
5. To instill in graduate students the skills to independently, constantly acquire, develop and apply professional knowledge, skills and abilities to solve non-standard tasks.
6. To teach graduate students to apply the knowledge of pedagogy and psychology of higher education in their teaching activities, as well as apply interactive teaching methods.
7. Familiarize undergraduates with conducting system analysis to solve complex technical problems and applying the analysis results to optimize the software development process to the greatest extent possible.
8. Teach undergraduates to optimize the software development process.
9. To teach a generalization of the results of research and analytical work in the form of a dissertation, a scientific article and reports at scientific and technical 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 research activities that require in-depth professional knowledge.
- Apply data analysis methods to solve various problems of data analysis and analytical processing.
- Apply methodological and methodological knowledge in the conduct of scientific research, pedagogical and educational work.
- Apply psychological methods and means of improving the effectiveness and quality of education in the learning process.
- To have a foreign language at a professional level, allowing to conduct research and teach special subjects in universities.
- Simulate and design complex systems.
- Apply quantitative methods and techniques to develop effective solutions to problems.
- Create a database for efficient storage and data management for various big organizations, government agencies, etc.
- Manage the team in the software development process.
- Select standards, methods, technologies, tools and hardware for software maintenance work.

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	Software Engineering
5	Type of EP	New EP
6	Goal 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	KC1: The ability to use the knowledge gained for the original development and application of ideas in the context of scientific research. KC2: The ability to critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena. KC3: The ability to independently, constantly acquire,

		develop and apply professional knowledge and skills for solving non-standard tasks. KC4: The ability to apply the knowledge of pedagogy and psychology of higher education in their teaching activities, and interactive teaching methods. KC5: The ability to speak a foreign language at a professional level, which allows conducting research and teaching special disciplines in universities. KC6: The ability to select and develop methods for analyzing objects of professional activity based on general trends in the development of software engineering. KC7: The ability to apply the obtained theoretical and practical knowledge in solving practical problems in the field of ICT, successfully carry out managerial and research activities. KC8: The ability to independently formulate the subject area of a software project, determine the requirements and expectations of the end user, draw up a phased development plan and develop documentation for software and its components. KC9: The ability to carry out system analysis to solve complex technical problems and apply the results of the analysis to the greatest optimization of the software development process. KC10: The ability to apply effective methods in project management, distribute tasks and manage a team of developers. KC11: The ability to develop software architectures with a high level of continuity and quality of complex software development using advanced ICT solutions. KC12: The ability to conduct analysis to solve complex software (technical) problems and ensure the implementation of the most optimal solutions for debugging software. KC13: The ability to introduce innovative methods and improvements that enhance the competitiveness and effectiveness of software at all stages of the software product life cycle. KC14: The ability to optimize the software development process. KC15: The ability to summarize the results of research and analytical work in the form of a dissertation, a scientific article and reports at scientific and technical conferences, a report, an analytical note, etc.
12	Learning outcomes	LO1: Formulate and solve problems arising in the course of research activities that require in-depth professional knowledge. LO2: Apply data analysis methods to solve various problems of data analysis and analytical processing. LO3: Apply methodological and methodological knowledge in the conduct of scientific research, pedagogical and educational work.

		LO4: Apply psychological methods and means of improving the effectiveness and quality of education in the learning process. LO5: To have a foreign language at a professional level, allowing to conduct research and teach special subjects in universities. LO6: Simulate and design complex systems. LO7: Apply quantitative methods and techniques to develop effective solutions to problems. LO8: Create a database for efficient storage and data management for various big organizations, government agencies, etc. LO9: Manage the team in the software development process. LO10: Select standards, methods, technologies, tools and hardware for software maintenance work.
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	Testing Web and multimedia applications, Software development, Development of artificial intelligence applications, Software testing
21	Atlas of new professions	Blockchain-technologist, Devops engineer, Developer universal ai, Product-manager
22	Regional standard	Not provided

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
KK1	V		V			V				
KK2							V			
KK3								V	V	
KK4			V	V						
KK5					V					
KK6						V				
KK7							V	V	V	
KK8	V	V	V			V	V			
KK9		V				V				
KK10						V			V	V
KK11						V	V			V
KK12	V					V		V		
KK13								V		
KK14						V			V	
KK15							V			

4.3 Information about courses

№	Наименование дисциплины	Краткое описание дисциплины	Кол-во кредитов	Формируемые компетенции (коды)
		Basic disciplines **University component**		
1.	History and philosophy of science	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
2.	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	PC4 LO3
3.	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	PC4 LO4
4.	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	4	PC5 LO5

		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.		
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.	Decision Support Systems	The aim of this course is to introduce master students to the concepts, processes of predictive modeling and their practical use, and to the field of prescriptive analytics, which is used to make decisions based on data. In addition, the course is designed to use data and models in real-life decision-making scenarios in manufacturing, supply chain, finance, HR, and more. Using practical examples, this course teaches how to transform a problem scenario into a mathematical model that can be solved, to get the best results for your business.	5	PC6, 7, 8 LO10
7.	DevOps	This course examines the key concepts and principles of DevOps, organizational factors and automation tools in the development of software products in this way. After completing this course, master students will be able to synchronize the stages of software product development, QA, automate tasks, and apply a methodology that helps automate workflows, which will increase the speed and productivity of developers, testers and system administrators..	5	PC6, 7, 8 LO8
8.	Parallel Computing	This course covers parallel computing methods applied to the main computational algorithms, advanced software packages for parallel computing, as well as big data processing and large-scale modeling problems in various sciences and fields of activity are considered.	5	PC11, 12 LO7
		Profession disciplines **University component**		
9.	Theory and Technology of Blockchain	The purpose of this course is to introduce master students to blockchain technology, its capabilities and prospects. The course examines the mathematical, cryptographic foundations and the use of this technology for solving applied problems (smart contracts, supply chain management, digital signatures and algorithms for their verification).	4	PC6, 7, 8 LO6, LO7
10.	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	PC1, 9 LO1, LO3
11.	Software Development Management and Reengineering	The purpose of this course is to teach master students to analyze and design software, manage a team in the software development process, determine and evaluate the degree of responsibility of project team members.	5	PC6, 7, 8 LO9
12.	Advanced Programming	The aim of this course is to learn advanced programming techniques, it covers algorithm design techniques such as divide and conquer, dynamic programming and greedy algorithms, undecidability (NP-completeness) and the use of linear/integer programming to solve optimization problems. In addition, the course also covers additional topics related to data structures.	4	PC8, 9 LO6, LO8
13.	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	PC8, 10, 11 LO9

Profession disciplines Electives				
14.	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	PC11, 15 LO1, LO6
	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.		PC11, 14 LO5, LO6, LO7
	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 LO6
15.	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.	5	PC6, 7, 8 LO6, LO7
	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.		PC11, 14 LO2, 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.	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 LO2, LO7
	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 LO4, LO6, LO7
	Public speaking	The art of public speaking includes the knowledge and skills of a speaker in preparing and delivering a public speech: the ability to select material, the art of constructing a speech in order to have a certain impact on listeners, the ability to prove and refute, the ability to convince; speech skill. This course examines the purpose and characteristics of public speech, ways and methods of argumentation, speech means of logic and the impact of speech, ethics of the speaker's speech behavior. Recommendations are given on the choice and use of language tools and the prevention of speech errors.		PC8, 9, 13 LO4
17.	IoT and artificial intelligence	The aim of this course is to teach master students advanced artificial intelligence methods that can be useful for industrial automation, environmental assessment, as well as for human-computer interaction, etc.	5	PC11, 14 LO2, LO7
	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
	Effective	The purpose of this course is to form the basic knowledge, skills		PC8, 9,

	communication	and practical skills of using modern communication strategies as a mechanism for building communication links. The course includes mastering the techniques of interaction and influence that allow you to adequately respond to the situation, communicate freely and effectively, interact effectively with people, use various behaviors, holistically understand your own and common interests, set priorities and make choices.		13 LO1, LO4
	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)																
SPS7001	History and philosophy of science	4	1	Ex		120	30	15	15		90	15	75	4			
SPS7002	High School of Pedagogy	4	1	Ex		120	30	15	15		90	15	75	4			
SPS7003	Psychology of management	4	2	Ex		120	30	15	15		90	15	75		4		
LAN7001A	Foreign language (professional)	4	2	ex		120	30		30		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)																
ANL 7303	Decision Support Systems	5	2			150	45	15	30		105	15	90		5		
SFT7305	DevOps	5	2			150	45	15	30		105	15	90		5		
SFT7306	Parallel Computing	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	1			120	30	15	15		90	15	75	4			
SFT7303	Software Development Management and Reengineering	5	1			150	45	15	30		105	15	90	5			
SFT7304	Advanced Programming	4	1			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			
ANL7305	Machine Learning and Computer Statistics																
ANL7304	Natural Language Processing																
NET7301	Implementation and Operation of Basic Enterprise Network Technologies																
	Elective course 2	5	2			150	45	15	30		105	15	90		5		
SFT7307	Geographic Information Systems																
ANL7306	Computer Vision																
NET7302	Implementing Cisco Enterprise Advanced Routing and Services																
	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**			**32**	**31**	**29**	**28**

6 Developer approval sheet

The title of the educational program: 7M06101 «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	PhD, assistant-professor of the «CE» department A.A. Sarsembayev	30.03.2023		
3	MSc, senior lecturer of the «CE» department L.A. Kozina	30.03.2023		