Ministry of Science and Higher Education of the Republic of Kazakhstan
NJSC «Korkyt Ata Kyzylorda University»



GRADUATE MODEL

of the educational programe 8D06151-"Computer engineering and software"

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INTRODUCTION

The Graduate Model of Korkyt Ata Kyzylorda University represents a set of professional, general cultural, and personal competencies developed throughout the learning process at all levels of education. It serves as a foundation for designing educational programmes in accordance with the requirements of the Bologna Process, employers' expectations, and the needs of the modern labour market.

The development of competitive graduates is ensured through highly qualified academic staff, comprehensive educational, methodological and information support, as well as the continuous improvement of the University's material and technical resources.

1. DESCRIPTION OF THE EDUCATIONAL PROGRAMME

The doctoral educational programme 8D06151 – "Computer Engineering and Software" is aimed at training highly qualified research and academic personnel with fundamental knowledge, research skills, and professional competencies in the fields of computer engineering, software engineering, and information and communication technologies.

2. COMPONENTS OF THE GRADUATE MODEL DEVELOPMENT FOR THE EDUCATIONAL PROGRAMME

The key components of the Graduate Model include information on the aims and objectives of the educational programme, the objects, types and areas of professional activity, the competency-based model of the specialist (Appendix 1), including descriptors, types of competencies in accordance with the educational programme, and the learning outcomes of the programme.

2.1. Aim of the Educational Programme

To train highly qualified research and academic personnel with in-depth knowledge in computer engineering and software, capable of conducting independent scientific research, developing innovative solutions, and implementing advanced information technologies.

2.2. Objectives of the Educational Programme

- To develop advanced professional competencies in computer engineering, software, information systems, and modern digital technologies based on fundamental scientific knowledge.
- To develop independent research skills aimed at solving current scientific and technical problems in the field of information and communication technologies.
- To prepare doctoral students to develop innovative methods, models, and algorithms for improving computing processes, software systems, and information technologies.
- To develop competencies in modern areas of computer science, including artificial intelligence, machine learning, intelligent information systems, big data analytics, and cloud computing.
- To develop the ability to critically analyse and evaluate scientific research, synthesise the findings of domestic and international research, and identify promising areas for the development of the industry.
- To develop scientific communication and academic writing skills, prepare research publications for international peer-reviewed journals, and present and validate research findings at international scientific conferences.

- To train academic personnel capable of teaching in higher and postgraduate education institutions, as well as developing and improving educational programmes and teaching materials.
- To develop skills in implementing research findings in the practical activities of organisations and enterprises, and in creating competitive software products and innovative technological solutions.
- To foster professional responsibility and research ethics, as well as the ability to comply with the principles of academic integrity, copyright, and ethical standards in conducting scientific research.
- To ensure integration into the international research and educational environment through academic mobility, international scientific cooperation, and participation in joint research projects.

2.3. General and Professional Competencies

General Competencies:

- Ability to engage in abstract thinking, analysis, synthesis, critical evaluation of scientific information, and generation of new scientific ideas.
- Ability to conduct independent research, identify relevant scientific problems, formulate research hypotheses, and substantiate methods for solving them.
- Ability to communicate effectively in the state, Russian, and foreign languages and present research findings to the international academic community.
- Ability to comply with the principles of academic integrity, research ethics, copyright, and intellectual property rights when conducting scientific research.
- Ability to pursue continuous professional and personal development, lifelong learning, and adaptation to changes in scientific, technological, and information-related fields.
- Ability to organise scientific and professional activities, manage research projects, and work in interdisciplinary and international research teams.
- Ability to conduct academic and teaching activities and apply modern educational technologies and teaching methods in higher and postgraduate education.

Professional Competencies:

- Ability to conduct fundamental and applied research in computer engineering, software, and information and communication technologies.
- Ability to apply modern artificial intelligence methods, machine learning, data mining, and neural network technologies to solve complex scientific and applied problems.
- Ability to design, develop, and investigate complex software systems, computing system architectures, and hardware-software complexes.
- Ability to research and develop high-performance, distributed, cloud-based, and intelligent computing systems, ensuring their reliability, security, and efficiency.
- Ability to apply modern methods of big data analytics, modelling, optimisation, and forecasting to solve scientific, technical, and industrial problems.
- Ability to develop and implement innovative information technologies and evaluate the effectiveness of proposed technical and software solutions.
- Ability to critically analyse the results of their own and international scientific research, formulate scientific novelty, and substantiate the theoretical and practical significance of the findings.
- Ability to prepare scientific publications, monographs, research reports, and dissertations in accordance with international academic standards.

- Ability to conduct academic and teaching activities and develop courses, educational programmes, and teaching materials in computer engineering and software.
- Ability to manage research projects, organise the implementation of research findings, and ensure their commercialisation and practical application.
- Ability to assess the development prospects of modern information technologies, identify priority research areas, and develop strategic solutions in the field of digital transformation.

2.4. Matrix of Alignment of Educational Programme Learning Outcomes with the Competencies Developed

Competencies	LO1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8
GEC 1	+							
GEC 2		+						
SC1				+				
SC2			+				+	
SC2						+	+	
SC3					+			+
SC3					+			+
SC4		+						+
SC5		+			+			
SC6		+						+
SC7								+

LO1	LO1. Able to develop and publish scientific articles in compliance with the requirements for structure, argumentation, and academic style, as well as effectively use academic sources, citations, and bibliographic formatting in international publications. Applies modern educational technologies in the teaching process.
LO2	LO2. Demonstrates proficiency in modern research methods, processing and interpretation of experimental data, and applies research findings and contemporary research approaches in the educational process when addressing scientific and professional tasks.
LO3	LO3. Applies and evaluates algorithms and models for various software and hardware computing environments, using modern methods of their analysis and optimisation in educational and research activities.
LO4	LO4. Able to develop and apply scientific computing methods for modelling, analysis, and optimisation, use them in research and educational activities to solve professional tasks, and apply theoretical knowledge and modern research methods in professional practice.
LO5	LO5. Able to design and develop intelligent computing and robotic systems, develop and optimise artificial intelligence algorithms for automated analysis, and apply research findings and modern digital technologies in research and educational activities.
LO6	LO6. Able to solve scientific and technical problems in the field of data processing and decision support systems, and apply modern data analysis methods and research findings in scientific and educational activities.
LO7	LO7. Able to conduct experimental studies of software and hardware configurations, interpret and predict their results, and use modern experimental analysis methods in research and educational activities.

LO8	LO8. Able to apply intelligent systems development technologies, knowledge representation and processing methods, and modern distributed computing technologies in solving professional tasks, as well as use them in educational and research activities.

2.1 Personal Qualities of a Specialist in Information Security

- Analytical Skills – the ability to conduct a systematic analysis of complex scientific and technical problems, process and interpret large volumes of information, identify patterns, formulate scientific hypotheses, and substantiate research decisions in the field of computer engineering and software.
- Diagnostic Skills – the ability to identify and analyse problems in the operation of computing systems, software suites, and information technologies; determine the causes of technical failures; evaluate the effectiveness of algorithms and software solutions; and detect errors and vulnerabilities.
- Verbal and Non-verbal Communication Skills – the ability to communicate effectively with the academic community, colleagues, and students; present research findings in a well-reasoned manner; deliver presentations at scientific conferences; prepare academic publications; conduct classes; and participate in international academic communication.
- Forecasting Skills – the ability to analyse prospects for the development of computer engineering, software engineering, artificial intelligence, and digital technologies; forecast technological trends; assess potential risks; and identify promising areas for scientific research.
- Corrective Skills – the ability to improve mathematical models, algorithms, software products, and computing systems based on experimental research findings; eliminate identified shortcomings; optimise technological processes; and implement innovative solutions.
- Research Skills – the ability to independently plan and conduct fundamental and applied scientific research, develop new scientific approaches, methods, and technologies, and ensure the reliability and reproducibility of research results.
- Critical Thinking – the ability to objectively evaluate scientific theories, methodologies, and research findings, identify the limitations of existing solutions, and substantiate the scientific novelty of one's own developments.
- Creativity and Innovation – the ability to generate original scientific ideas, develop unconventional approaches to solving complex problems, and create innovative hardware and software solutions.

Types of Professional Activity

A Doctor of Philosophy (PhD) in the Educational Programme 8D06151 – Computer Engineering and Software may engage in the following types of professional activities:

- Research and development activities;
- Design and engineering activities;
- Production and technological activities;
- Organisational, managerial, and teaching activities.

CONCLUSIONS

A graduate of the Educational Programme 8D06151 – “Computer Engineering and Software” is capable of conducting research activities, generating new scientific knowledge, developing innovative technological solutions, and contributing to the advancement of computer science and the digitalisation of the economy and society.

The awarded qualification enables graduates to pursue professional careers in research institutions, higher education organisations, IT companies, innovation centres, as well as public and private organisations engaged in the development, research, and implementation of advanced information technologies.

Appendix 1

The graduate's competence model

Module	DDB (Dublin Descriptors of bachelor)	Emerging competencies			Planned learning outcomes
		general education competencies	basic competencies	professional competencies	
1	2	3	4	5	6
M1	DDB1 DDB2 DDB3 DDB4 DDB5	GEC 1, GEC 2, GEC3, GEC 4, GEC 5			**LO1.** Able to develop and publish scientific articles in compliance with the requirements for structure, argumentation, and academic style, as well as effectively use academic sources, citations, and bibliographic formatting in international publications. Applies modern educational technologies in the teaching process.
M1	DDB1 DDB2 DDB3 DDB4 DDB5	GEC 6			**LO2.** Demonstrates proficiency in modern research methods, processing and interpretation of experimental data, and applies research findings and contemporary research approaches in the educational process when addressing scientific and professional tasks.
	DDB1 DDB2 DDB3 DDB4 DDB5	GEC7, GEC 8			**LO3.** Applies and evaluates algorithms and models for various software and hardware computing environments, using modern methods of their analysis and optimisation in educational and research activities.
M3	DDB1 DDB2 DDB3 DDB4 DDB5		SC1, SC2, SC4, SC10		**LO4.** Able to develop and apply scientific computing methods for modelling, analysis, and optimisation, use them in research and educational activities to solve professional tasks, and apply theoretical knowledge and modern research methods in professional practice.

	DDB1 DDB2 DDB3 DDB4 DDB5		SC3, SC7		**LO5.** Able to design and develop intelligent computing and robotic systems, develop and optimise artificial intelligence algorithms for automated analysis, and apply research findings and modern digital technologies in research and educational activities.
M2	DDB1 DDB2 DDB3 DDB4 DDB5		SC5		**LO6.** Able to solve scientific and technical problems in the field of data processing and decision support systems, and apply modern data analysis methods and research findings in scientific and educational activities.
	DDB1 DDB2 DDB3 DDB4 DDB5		SC6		**LO7.** Able to conduct experimental studies of software and hardware configurations, interpret and predict their results, and use modern experimental analysis methods in research and educational activities.
M3	DDB1 DDB2 DDB3 DDB4 DDB5		SC8 SC12		**LO8.** Able to apply intelligent systems development technologies, knowledge representation and processing methods, and modern distributed computing technologies in solving professional tasks, as well as use them in educational and research activities.
M5	DDB1 DDB2 DDB3 DDB4 DDB5		SC9		**LO1.** Able to develop and publish scientific articles in compliance with the requirements for structure, argumentation, and academic style, as well as effectively use academic sources, citations, and bibliographic formatting in international publications. Applies modern educational technologies in the teaching process.