Institute of Automation and Information Technologies
Department of Automation and Control

EDUCATIONAL PROGRAM
8D07101 - AUTOMATION AND ROBOTIZATION

code and name of the educational program

Code and classification of the field of education: **8D07 Engineering, manufacturing and construction industries**
Code and classification of areas of study: **8D071 Engineering and Engineering affairs**
Group of educational programs: **D100 Automation and management**
NQF level: **8**
ORC level: **8**
Duration of study: **3 years**
Volume of credits: **180 credits**

Almaty 2025

The education program **"8D07101 – Automation and robotization"** was approved at a meeting of the Academic Council of KazNITU named after K. I. Satbayev.

Protocol №10 «06» March 2025 y.

Reviewed and recommended for approval at the meeting of the Teaching and Methodological Council of KazNITU named after K. I. Satbayev.

Protocol №3 «20» December 2024 y.

The educational program **«8D07101 – Automation and robotization»** has been developed by the academic committee of **«8D071 Engineering and Engineering affairs».**

Full name	Scientific degree / Academic title	Position	Workplace	Caption
Chairman of the academic committee:				
Sarsenbayev Nurlan	Candidate of technical sciences	Associate professor, head of the department	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Teaching staff:				
Suleymenov Batyrkbek	Doctor of technical sciences	Professor	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Beisembayev Akhambay	Candidate of technical sciences	Associate professor	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Shiryayeva Olga	Candidate of technical sciences	Associate professor	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Omirbekova Zhanar	Doctor PhD	Associate professor	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Employers:				
Abdigaliyev Serik	APCS engineer	General director	LLP «АСУТП-Honeywell»	
Saurambayev Zhiger	APCS engineer	Head of Industrial Automation and Solutions for Kazakhstan and Central Asia	Schneider Electric Kazakhstan	
Yunatanov Yurii	APCS engineer	General director	Process Automation LLP, Kazakhstan	
Students:				
Zhailimisova Gulnaz	PhD	2st year PhD student	-	

Table of Contents

List of abbreviations and symbols

EP	Educational program
DC	Dynamic systems
CS	Control systems

1. Description of the educational program

The educational program (here in after EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I. Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan.

The educational program 8D07101 - Automation and Robotization of Doctor of Philosophy training has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the areas of automation and robotics for the postgraduate education system and the research sector.

Objects of professional activity:

- automation and process control systems;
- robotic systems and complexes;
- training of undergraduate, graduate and doctoral students in special disciplines.

Types of work activity of doctoral graduates in the management of automated systems should have competencies in accordance with the types of professional activity:

in the field of production and technological activities:

- be the head of the production unit for the operation, maintenance, repair and adjustment of technical means of automated control systems for production processes in various industries;

in the field of organizational and managerial activities:

- to be the head of the scientific department dealing with the problems of automation of production processes, the department of the university, the department for the operation, maintenance and repair of elements, automated devices and control systems for production processes in various industries;

in the field of experimental research activities:

- to be the head of a scientific laboratory for conducting theoretical and experimental studies of industrial automation objects;

in the field of research and teaching activities:

- be a leading researcher or head of a scientific laboratory for the research and development of modernautomated control systems in various industries;
- be a teacher of undergraduate, graduate and doctoral disciplines in special disciplines in the field of automated systems management and automation of production processes;

in the field of designdesign activities:

- to be the head of the department for the development and design of automated control systems for production processes in various industries.

In the field of control of robotic systems, he must have competencies in accordance with the types of professional activity:

in the field of production and technological activities:

- be the head of the production unit for the operation, maintenance, repair and adjustment of technical means of robotic systems in various industries;

in the field of organizational and managerial activities:

- to be the head of the scientific department dealing with the problems of robotization of production processes; subdivisions of the university, subdivisions for the operation, maintenance and repair of elements, devices of robotic systems in various industries;

in the field of experimental research activities:

- to be the head of a scientific laboratory for conducting experimental studies of objects of robotization of industrial production;

in the field of research and teaching activities:

- be a leading researcher or head of a scientific laboratory for the research and development of modernrobotic systems, in various industries;
- be a teacher of undergraduate, graduate and doctoral studies in special disciplines in the field of control of robotic systems and robotization of production processes;

in the field of designdesign activities:

- to be the head of the division for the development of robotic systems in various industries.

2. Purpose and objectives of the educational program

Purpose of the EP:

The preparation of highly qualified scientific and pedagogical personnel, proficient in modern methods of automation, robotics, and intelligent management, capable of developing innovative solutions, conducting world-class scientific research, and contributing to the sustainable development of society through the integration of science, technology, and education.

Tasks of the EP:

Based on the achievements of modern science, technology and production, to provide knowledge and skills in the field of:

- automation;
- robotics;
- artificial intelligence;
- automated control;
- Preparation and defense of a doctoral dissertation.

3. Requirements for evaluating the learning outcomes of an educational program

EP 8D07101 - "Automation and Robotization" ensures that all students achieve the learning outcomes necessary for professional activities. At the end of the program, students should:

- own the methods of system analysis: data collection, research of information flows, building models and choosing the structures of automated and robotic systems.

- know the basic methods of analysis and synthesis of dynamic systems (DS): bifurcation theory, fractal dimension and catastrophe theory.

- own intellectual methods of synthesis of control systems: expert systems, fuzzy logic, neural network structures.

- own methods of synthesis of optimal and adaptive control systems. Know the basics of solving classical and non-classical problems of the calculus of variations.

- possess the skills of conducting research work and preparing scientific publications on the development of automated process control systems and robotic technological complexes in various industries.

- be able to perform computational research work on the design and operation of control systems based on modern computer technology.

4. Passport of the educational program

4.1. General information

No.	Field name	Note
1	Code and classification of the field of education	8D07 Engineering, manufacturing and construction industries
2	Code and classification of areas of study	8D071 Engineering and Engineering affairs
3	Group of educational programs	D100 Automation and management
4	Name of the educational program	8D07101 - Automation and robotization
5	Brief description of the educational program	The educational program 8D07101 - Automation and Robotization of Doctor of Philosophy training has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the areas of automation and robotics for the postgraduate education system and the research sector.
6	Purpose of the EP	The preparation of highly qualified scientific and pedagogical personnel, proficient in modern methods of automation, robotics, and intelligent management, capable of developing innovative solutions, conducting world-class scientific research, and contributing to the sustainable development of society through the integration of science, technology, and education.
7	EP type	New EP
8	NQF level	8
9	ORC level	8
10	Distinctive features of the EP	No
11	List of competencies of the educational program:	A doctoral student who graduates from this program acquires the following competencies: - own the methods of system analysis: data collection, research of information flows, building models and choosing the structures of automated and robotic systems. - generate their own new scientific ideas, communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge. - demonstrate teaching skills in undergraduate and graduate programs, supervise the scientific work of students and undergraduates. - to contribute with their own original research to the expansion of the scientific field, which deserve publication at the national or international level. - demonstrate high professional qualities and ethics when interacting with various stakeholders.

12	Learning outcomes of the educational program:	LO1 – Know intelligent methods for synthesizing control systems: expert systems, fuzzy logic, neural network structures, analyze and design control systems using mathematical methods of adaptive control. LO2 – Master the methods of synthesis of optimal and adaptive control systems. Know the basics of solving classical and non-classical problems of the calculus of variations. LO3 – Possess the skills to conduct research and the preparation of scientific publications on the development of automated process control systems and robotic technological complexes in various industries. LO4 – To possess methods of system analysis: data collection, research of information flows, building models and choosing structures of automated and robotic systems. LO5 – Possessing the skills to conduct scientific research and prepare scientific publications on the development of automated control systems for technological processes and robotic technological complexes aimed at improving energy efficiency, LO6 – Being able to perform computational and research tasks for the design and operation of control systems based on modern computing technologies to create environmentally sustainable, safe, and resource-saving manufacturing processes.
13	Form of study	full-time
14	Training period	3 years
15	Volume of credits	180 credits
16	Languages of instruction	Kazakh, Russian
17	Awarded Academic Degree	Doctor of Philosophy (PhD)
18	Developer(s) and authors:	Aldiyarov N.U., Manatov K. A.

4.2. The relationship between the achievability of the formed learning outcomes in the educational program and academic disciplines

No.	Name of the discipline	Brief description of the discipline	Number of credits	Formed learning outcomes (codes)					
				LO1	LO2	LO3	LO4	LO5	LO6
Cycle of basic disciplines University component									
1	Academic writing	Objective: to develop academic writing skills and writing strategies for doctoral students in engineering and natural sciences. Content: fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, and references; in-text citation; preventing plagiarism; and preparing a conference presentation.	5	**V**				**V**	
2	Research methodology	Objective: to acquire knowledge about the laws, principles, concepts, terminology, content, and specific features of organizing and managing scientific research using modern scientometric methods. Content: the structure of technical sciences, the application of general scientific, philosophical, and specialized methods of scientific research, principles of organizing scientific research, methodological features of modern science, ways of developing science and scientific research, the role of technical sciences, informatics, and engineering research in theory and practice.	5	**V**					**V**
Cycle of basic disciplines University component									
3	Sustainability Science	Objective: to develop a deep understanding among doctoral students of the interactions between natural and social systems, as well as to develop skills for identifying and developing strategies for sustainable development that promote long-term human well-being and environmental preservation. Content: complex interconnections between ecosystems and societies, as well as an in-depth analysis of sustainability issues at local, national, and international levels.	5					**V**	**V**
4	Theory of Dynamic Systems	The course covers the following main sections of the theory of dynamical systems: - Basic concepts of the theory of dynamical systems. - Mathematical models and classification of dynamical systems. - Analysis of dynamic systems on the phase plane. - Basic concepts of singularity theory, bifurcation theory, fractal dimension. - Chaotic dynamics and dynamic chaos. - Structural stability of nonlinear systems and the theory of catastrophes.	**5**		**V**	**V**	**V**		

Cycle of major disciplines Selectable Component									
5	Mathematical methods of adaptive control	The course covers the following main sections of adaptive systems: - Management in conditions of uncertainty. Basic concepts and approaches to the formation of the concept of adaptive management. - Tasks and methods of synthesis of adaptive control systems. - Adaptive identification type systems. - Discrete adaptive systems with a configurable model of the control object. - Direct adaptive control. Adaptive systems with explicit and implicit reference model of the main contour. - Adaptive neural network control systems.	5		**V**	**V**	**V**		
6	Subsystems of diagnostics in control systems	The discipline "diagnostic subsystems in control systems" presents the basic concepts and definitions found in the theory of reliability, quantitative indicators of system reliability, methods of calculating systems for reliability, system redundancy, testing systems for reliability, processing test results and evaluating reliability indicators. The purpose of this diagnostic system is a joint analysis of interrelated controlled technological characteristics. The issues of application of intelligent technologies for synthesis of subsystems of diagnostics of technological equipment are considered.	5	**V**	**V**				
7	Modern technical means in CS	In the course "Modern technical means in CS", the technical means of automation and control systems of technical objects and technological processes such as controlled voltage converters, automated electric drives of direct and alternating currents, control and measuring means, actuators, technical means of receiving, converting and transmitting measuring and command information via communication channels, technical means of processing, storing information and generating control actions, industrial information networks are considered, software, technical means for displaying technological processes.	5				**V**		**V**
8	Electronics power devices	The discipline "Electronics of power devices" is one of the basic special courses for the specialty of automation and control. The course consists of the main parts: conversion of alternating current to direct current - rectifiers; pulse regulation of direct and alternating voltage - pulse converters; frequency regulation of voltage or current - frequency converters.	5				**V**	**V**	

5. Curriculum of the educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**D100 - "Automation and management"**
Educational program	**8D07101 - "Automation and robotization"**
The awarded academic degree	**Doctor of Philosophy PhD**
Form and duration of study	**full time (scientific and pedagogical track) - 3 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters						Prerequisites
									1 course		2 course		3 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)															
CYCLE OF BASIC DISCIPLINES (BD)															
M-1.Module of basic training (university component)															
CSE339	Research methodology		BD, UC	5	150	30/0/15	105	E	5						
LNG305	Academic writing		BD, UC	5	150	0/0/45	105	E	5						
AUT314	Theory of Dynamic Systems	1	BD, CCH	5	150	30/0/15	105	E	5						AUT237
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
M-3.Practice-oriented module															
AAP350	Pedagogical practice		BD, UC	10				R		10					
CYCLE OF PROFILE DISCIPLINES (PD)															
M-2.Module of professional activity (component of choice)															
AUT305	Modern technical means in SU	1	PD, CCH	5	150	30/0/15	105	E	5						AUT239
AUT316	Electronics power devices	1	PD, CCH	5	150	15/15/15	105	E	5						AUT237
AUT317	Mathematical methods of adaptive control	2	PD, CCH	5	150	30/0/15	105	E	5						AUT232
AUT302	Subsystems of diagnostics in control systems	2	PD, CCH	5	150	30/15/0	105	E	5						AUT269
M-3.Practice-oriented module															
AAP355	Research practice		PD, UC	10				R			10				
M-4.Experimental research module															
AAP336	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	5				R	5						
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R		20					
AAP347	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	20				R			20				
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R				30			
AAP356	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	30				R					30		
AAP348	Research work of the doctoral student, including internships and doctoral dissertation		RWDS	18				R						18	
M-5.Module of final attestation															
ECA325	Final examination (writing and defending a doctoral dissertation)		FA	12										12	
Total based on UNIVERSITY:									30	30	30	30	30	30	
									60		**60**		**60**		

NJSC "Kazakh National RESEARCH Technical University"
named after K.I. Satpaev"

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	0	0	0	0
BD	Cycle of basic disciplines	0	20	5	25
PD	Cycle of profile disciplines	0	10	10	20
Total for theoretical training:		**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				123
ERWDS	Experimental Research Work of Doctoral Student				0
FA	Final attestation				12
TOTAL:					**180**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 1 dated 05.11.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. Б.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
acting Director of Institute - Institute of Automation and Information Technologies	Chinibayev Y. Г.
Department Chair - Automation and control	Sarsenbayev N. .
Representative of the Academic Committee from Employers ____Acknowledged____	Жигер С.

6. Additional educational programs (Minor)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of development additional educational programs (Minor)