Institute of Automation and Information Technologies
Department of Automation and Control

EDUCATIONAL PROGRAM
8D07118 – INDUSTRIAL AUTOMATION
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 **"8D07118 – Industrial automation"** 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 **«8D07118 – Industrial automation »** has been developed by the academic committee of **«8D071 Engineering and Engineering affairs».**
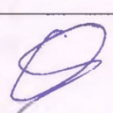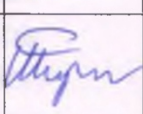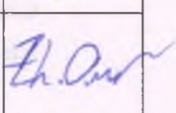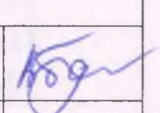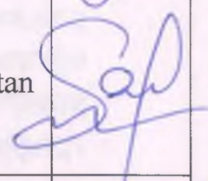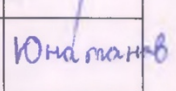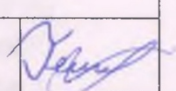
Full name	Scientific degree / Academic title	Position	Workplace	Caption
Chairman of the academic committee:				
Sarsenbayev Nurlan	Candidate of technical sciences	Associate professor, head of the department	NAO «Kazakh National Research Technical University named after K. I. Satbayev»	
Teaching staff:				
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
IIoT	Industrial Internet of Things

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 8D07118 – Industrial automation of Doctor of Philosophy training has a scientific and industrial focus and involves fundamental, methodological and research training and in-depth study of disciplines in the areas of automation and robotics for the postgraduate education system.

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 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 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 goal of the educational program is to train highly qualified specialists proficient in modern methods for solving production tasks in industrial automation and capable of engaging in innovative activities aimed at sustainable development, improving energy efficiency, reducing environmental impact, and efficient resource utilization in industry.

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 8D07118 - "Industrial automation" 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	8D07118 – Industrial automation
5	Brief description of the educational program	The educational program 8D07118 – Industrial automation of Doctor of Philosophy training has a scientific and industrial focus and involves fundamental, methodological and research training and in-depth study of disciplines in the areas of automation and robotics for the postgraduate education system.
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	Innovative 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. - 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 – Apply skills in scientific research methods to solve scientific and technical problems in automation and control in various industries. LO2 – Demonstrate academic writing skills when performing research papers, information and analytical materials and presentations. Demonstrate academic writing skills in conducting research work, be familiar with the rules of administrative documentation and business correspondence, observe the ethics of business relations, possess competent oral and written speech in the state, Russian, and English languages, and use office software effectively. LO3 – Apply modern technologies, methods and approaches to automation of technological processes to increase efficiency, optimization, environmental friendliness of production processes and ensure sustainable development. LO4 – Plan, develop and implement innovative projects in the field of automation and control in various industries. Modernization and improvement of existing equipment, enhancement of its performance and reliability. LO5 – Development and implementation of intelligent control systems for the digital transformation of industrial processes, development of digital twins and models. LO6 – Design and develop Industrial Internet of Things (IIoT) applications tailored to Industry 4.0 industrial needs, architecture design, development and implementation of IoT networks. LO7 – Conduct innovative research in the field of predictive system diagnostics, machine learning and control. Identification of critical parameters requiring modernization, development of modernization projects for specific types of equipment.
13	Form of study	full-time
14	Training period	3 years
15	Volume of credits	180 credits
16	Languages of instruction	Kazakh, Russian, English
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	LO7
		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**						
		Cycle of basic disciplines Selectable Component								
3	Innovative projects in automation and control	The purpose of the discipline "Innovative projects in automation and control" is to prepare students for the development, implementation and management of innovative projects in the field of automation and process control. The course aims to develop creative thinking, understanding of modern technologies and methods, as well as project management skills to improve the efficiency, reliability and competitiveness of industrial systems. The learning process examines the basics of innovative projects, their classification and role in modern production, modern technologies and trends. Particular attention is paid to economic and social aspects, cost-effectiveness assessment, labor market and environmental impacts, as well as ethical and sustainable	5				**V**	**V**		

№	Discipline	Description	Credits								
		development issues. As part of the course, students analyze successful and unsuccessful cases, develop and defend their own projects, which contributes to the acquisition of comprehensive knowledge and practical skills for successful participation in innovative projects in the field of automation and control.									
4	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		
5	Advanced Process Control Systems	The purpose of the discipline is to prepare for the development, implementation and management of advanced control systems that ensure optimization, increased efficiency and stability of technological processes in industry. The course includes the study of advanced control principles, introducing the concepts and principles of advanced process control, including automation, control and optimization. Training in methods and technologies such as predictive management, model predictive management and other advanced techniques. Study of the integration of advanced management systems with information and communication systems to provide integrated production management. Development, implementation and management of advanced process control systems.	5					V	V		
	Cycle of major disciplines **Selectable Component**										
6	Intelligent control systems in industry	The goal of the discipline is to prepare highly qualified specialists for the development, research and implementation of intelligent control systems to optimize industrial processes. The course covers an in-depth study of methods and technologies associated with the development and application of intelligent systems for automation of production processes. Explores advanced approaches in artificial intelligence and automation, and studies algorithms and models for optimizing, monitoring and controlling complex industrial systems. The course also includes the analysis and development of intelligent solutions to improve the efficiency, reliability and sustainability of production processes.	5					V	V		
7	Predictive Intelligent Diagnostics for Industrial	The purpose of studying the discipline is to teach methods and tools for predicting and preventing failures and malfunctions in	5			V					V

	Automation	industrial automation systems using modern technologies and analytical methods. The training focuses on gaining a complete understanding of the principles and methodology of diagnostic automation systems, including control and optimal control to improve their efficiency and reliability. Mastery of a wide range of algorithms and machine learning methods specifically designed for use in predictive maintenance systems. Effective application of diagnostic systems and machine learning approaches in real industrial scenarios to improve efficiency, reliability and control: implementation of control automation and monitoring solutions. Conducting original research in the areas of diagnostic systems, machine learning and process control.									
8	Industrial digitalization and artificial intelligence	The goal of the discipline "Industrial digitalization and artificial intelligence" is to prepare students for the use of modern digital technologies and artificial intelligence methods to increase the efficiency, automation and innovation of industrial processes. During the training process, the concepts of digital transformation of industrial processes using digital twins and artificial intelligence technologies, the creation of digital models of real objects and processes are studied, as well as artificial intelligence methods and tools for optimizing production processes and risk management. The focus is on the practical application of these technologies in an industrial environment to create innovative and competitive solutions	5					**V**		**V**
9	Industrial Internet of Things (IIoT) for factory automation	The goal of the discipline is to prepare specialists to conduct advanced research and develop innovative solutions in the field of IIoT application for automation of production processes. The course is aimed at in-depth study of IIoT technologies, as well as developing skills in integrating and optimizing IIoT systems to increase the efficiency, flexibility and sustainability of industrial production. The course explores IIoT technologies and applications in the context of manufacturing process automation, exploring methods for integrating and managing these systems to improve production efficiency, reliability, and flexibility. The course includes practical aspects of IIoT implementation, analysis of real cases and project development, which allows students to acquire skills to solve modern industrial automation problems.	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	**8D07118 - "Industrial automation"**
The awarded academic degree	**Doctor of Engineering (Industry)**
Form and duration of study	**full time (professional 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	1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	Prerequisites
— Allocation of face-to-face training based on courses and semesters (1 course / 2 course / 3 course)															
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						
AUT322	Advanced Process Control Systems	1	BD, CCH	5	150	30/0/15	105	E	5						
AUT323	Innovative projects in automation and control	1	BD, CCH	5	150	30/0/15	105	E	5						
MNG350	Sustainability Science	1	BD, CCH	5	150	30/0/15	105	E	5						
CYCLE OF PROFILE DISCIPLINES (PD)															
M-2. Module of professional activity (component of choice)															
AUT324	Industrial digitalization and artificial intelligence	1	PD, CCH	5	150	30/0/15	105	E	5						
AUT325	Industrial Internet of Things (IIoT) for factory automation	1	PD, CCH	5	150	30/0/15	105	E	5						
AUT326	Predictive Intelligent Diagnostics for Industrial Automation	2	PD, CCH	5	150	30/0/15	105	E	5						
AUT327	Intelligent control systems in industry	2	PD, CCH	5	150	30/0/15	105	E	5						
M-3. Practice-oriented module															
AAP371	Industrial intership		PD, UC	20				R		20					
M-4. Experimental research module															
AAP372	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	5				R	5						
AAP376	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	10				R		10					
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R			30				
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R				30			
AAP374	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	30				R					30		
AAP375	Experimental research work of doctoral student, including internships and doctoral dissertations		ERWDS	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		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Required component (RC)	University component (UC)	Component of choice (CCH)	Total
		— Credits			
GED	Cycle of general education disciplines	0	0	0	0

BD	Cycle of basic disciplines	0	10	5	15
PD	Cycle of profile disciplines	0	20	10	30
	Total for theoretical training:	**0**	**30**	**15**	**45**
RWDS	Research Work of Doctoral Student				0
ERWDS	Experimental Research Work of Doctoral Student				123
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 № 4 dated 22.11.2024

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.

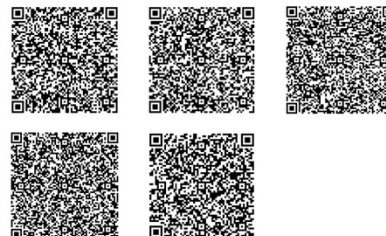acting Director of Institute - Institute of Automation and Information Technologies   Chinibayev Y. Г.

Department Chair - Automation and control   Sarsenbayev N. .

Representative of the Academic Committee from Employers
_____Acknowledged_____   Saurambayev Z.

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)