



Institute of Architecture and Construction named after T.K. Basenov

Department of "Engineering systems and networks"

**EDUCATIONAL PROGRAM
8D07304 "Engineering systems and networks"**

Code and classification of the field of education: **8D07 Engineering, manufacturing and civil engineering**

Code and classification of training directions: **8D073 Architecture and civil engineering**

Group of educational programs: **D127 Engineering systems and networks**

Level based on NQF: **8**

Level based on IQF: **8**

Study period: 3 years

Amount of credits: **180**

Almaty 2023

Educational program 8D07304 "Engineering systems and networks" was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes # 3 dated «27» 10 2022.

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council.

Minutes # 2 dated «21» 10 2022.

Educational program 8D07304 «Engineering systems and networks» was developed by Academic committee based on direction «Architecture and civil engineering»






Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Alimova Kulyash	cand. tech. sciences	Head department, associate professor	Department of "Engineering systems and networks" IAC named after T. K. Basenov	
Teaching staff:				
Halkhabay Bostandyk	cand. tech. sciences, docent	Associate Professor	department "Engineering systems and networks"	
Khoyshiev Amirkhan	cand. tech. sciences	Associate Professor	department "Engineering systems and networks"	
Employers:				
Zhumartova Aliya		headmaster	LLP "Research Center Eco Zhubalau"	
Students:				
Bayarystanov Madiyar		Student	4th course	

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List of abbreviations and designations

**NJSC KazNRTU named after K.I.Satbayev - Non-profit Joint Stock Company
"Kazakh National Research Technical University named after K.I.Satpayev";**

SCSE – State compulsory standard of education of the Republic of Kazakhstan;

EP – educational program;

SIS – student independent study (student, master student, doctoral student);

TSIS – independent work of a student with a teacher (student, master student,
doctoral student)

WC – working curriculum;

CED – catalog of elective disciplines;

UC – university component;

CC – component of choice;

NQF – national qualifications framework;

IQF– industry qualifications framework;

LO – learning outcomes.

1. Description of educational program

The PhD doctoral program is a professional educational program of postgraduate education aimed at training scientific and pedagogical personnel with the award of the degree of Doctor of Philosophy (PhD) with a standard training period of at least 3 years. The educational program for the preparation of a Doctor of Philosophy (PhD) involves fundamental educational, methodological and research training, and in-depth study of disciplines in the field of engineering systems of buildings and structures.

In the process of studying in the doctoral program, PhD students can realize all the opportunities for scientific activity, in particular, they have:

- access to all library resources and electronic catalogs;
- possibility of consultations with their scientific supervisors, other professors;
- the opportunity to communicate and consult with leading scientists from many foreign universities;
- the possibility of passing an internship abroad.

The PhD doctoral program is a professional educational program of postgraduate education aimed at training scientific and pedagogical personnel with the award of the degree of Doctor of Philosophy (PhD) with a standard training period of at least 3 years.

2. Purpose and objectives of educational program

Purpose of EP: The purpose of the educational program is to train highly qualified specialists with basic competencies in the field of solving organizational and production tasks in the implementation of innovative, research projects, the formation of personnel in the field of engineering systems and networks, covering modern energy and resource-saving technologies.

Tasks of EP: The main objectives of the educational program Doctor of Philosophy (PhD) or doctor in the profile of OP 8D07304 "Engineering systems and networks" are:

- ensuring the quality of education through the presentation of mandatory requirements for the level of training of doctoral students and educational activities of higher educational institutions;
- regularization of the rights of subjects of educational activity;
- improving the objectivity and informativeness of the assessment of doctoral students' training and the quality of educational programs;
- creating conditions for academic mobility of doctoral students;
- ensuring the functioning of the unified educational space of Kazakhstan;
- ensuring the recognition of the documents of the Republic of Kazakhstan on the award of the degree of doctor (PhD) or doctor in the profile in the international educational space and in the international labor market.

3. Requirements for evaluating the educational program learning outcomes

Persons who have mastered the educational program of doctoral studies and defended a doctoral dissertation, with a positive decision of the dissertation councils of a university with a special status or the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, according to the results of the examination, are awarded the degree of Doctor of Philosophy (PhD) or doctor in profile and a state-issued diploma with an appendix (transcript).

Persons who have received a PhD degree, in order to deepen scientific knowledge, solve scientific and applied problems on a specialized topic, perform a postdoctoral program or conduct scientific research under the guidance of a leading scientist of the chosen university.

Requirements for the key competencies of doctoral graduates:

- 1) have an idea:
 - about the main stages of development and paradigm shift in the evolution of science;
 - on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences;
 - about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;
 - about scientific concepts of world and Kazakh science in the relevant field;
 - on the mechanism of implementation of scientific developments in practical activities;
 - on the norms of interaction in the scientific community;
 - about the pedagogical and scientific ethics of a research scientist;
- 2) know and understand:
 - current trends, trends and patterns of development of Russian science in the context of globalization and internationalization;
 - methodology of scientific knowledge;
 - achievements of world and Kazakh science in the relevant field;
 - (realize and accept) the social responsibility of science and education; – perfect foreign language for scientific communication and international cooperation;
- 3) be able to:
 - to organize, plan and implement the process of scientific research;
 - analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
 - analyze and process information from various sources;
 - conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;
 - generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;
 - to choose and effectively use modern research methodology;

- plan and predict their further professional development; 4) have the skills:
 - critical analysis, evaluation and comparison of various scientific theories and ideas;
 - analytical and experimental scientific activities;
 - planning and forecasting of research results;
 - public speaking and public speaking at international scientific forums, conferences and seminars;
 - scientific writing and scientific communication;
 - planning, coordination and implementation of scientific research processes;
 - a systematic understanding of the field of study and demonstrate the quality and effectiveness of the selected scientific methods;
 - participation in scientific events, fundamental scientific domestic and international projects;
 - leadership management and team management;
 - responsible and creative attitude to scientific and pedagogical activity;
 - conducting patent search and experience in the transfer of scientific information using modern information and innovative technologies;
 - protection of intellectual property rights to scientific discoveries and developments;
 - free communication in a foreign language;
- 5) be competent:
 - in the field of scientific and scientific-pedagogical activity in the conditions of rapid updating and growth of information flows;
 - in carrying out theoretical and experimental scientific research;
 - in the formulation and solution of theoretical and applied problems in scientific research;
 - to conduct a professional and comprehensive analysis of problems in the relevant field;
 - in matters of interpersonal communication and human resource management; – in matters of university training of specialists;
 - in the examination of scientific projects and research;
 - in ensuring continuous professional growth.

Requirements for the research and development of a student under the Doctor of Philosophy (PhD) program:

- 1) compliance with the main problems of the educational program of the doctoral program on which the doctoral dissertation is being defended;
- 2) relevant and contains scientific novelty and practical significance;
- 3) based on modern theoretical, methodological and technological achievements of science and practice;
- 4) is based on modern methods of data processing and interpretation using computer technology;
- 5) performed using modern methods of scientific research;
- 6) contains research (methodological, practical) sections on the main protected provisions.

Requirements for the organization of practices:

The practice is conducted in order to form practical skills of scientific, scientific, pedagogical activities. The educational program of the doctoral program includes:

Pedagogical and research practice – for students of the PhD program;

During the period of pedagogical practice, doctoral students, if necessary, are involved in conducting classes in bachelor's and master's degrees.

The doctoral student's research practice is conducted in order to study the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as to consolidate practical skills, apply modern research methods, process and interpret experimental data in dissertation research.

The doctoral student's industrial practice is carried out in order to consolidate the theoretical knowledge gained in the course of training and improve the professional level.

The content of research and production practices is determined by the topic of the doctoral dissertation.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	8D07 Engineering, manufacturing and civil engineering
2	Code and classification of training directions	8D073 Architecture and civil engineering
3	Educational program group	D127 Engineering systems and networks
4	Educational program name	8D07304 Engineering systems and networks
5	Short description of educational program	<p>The innovative educational program provides training of scientific personnel focused on scientific, experimental research, pedagogical activities in the field of design of heat and gas supply, ventilation, water supply, sewerage, water supply and sanitation systems of settlements, industrial enterprises, water management and hydropower systems. The graduate is awarded the academic degree of Doctor of PhD.</p> <p>Doctoral students study the creation of new technologies in the field of heat and gas supply, ventilation, water supply, sewerage, hydraulic engineering and hydropower facilities.</p> <p>Much attention is paid to intellectual entrepreneurship, the development of applied projects for the real sector of the economy and the commercialization of launched projects.</p> <p>Doctoral students actively participate in research projects under the guidance of foreign consultants. Doctoral study plans include mandatory internships at leading foreign universities.</p> <p>Preparation and defense of the dissertation are conducted under the supervision of 2 scientific supervisors, domestic and foreign.</p>
6	Purpose of EP	The purpose of the educational program is to train highly qualified specialists with basic competencies in the field of solving organizational and production tasks in the implementation of innovative, research projects, the formation of personnel in the field of engineering systems and networks, covering modern energy and resource-saving technologies.
7	Type of EP	New
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	no
11	List of competencies of educational program	Universal, social and ethical competencies; Special and managerial competencies; Professional competencies.
12	Learning outcomes of educational program	LO1 to know the current trends, trends and patterns of development of Russian science in the context of globalization and internationalization;

		<p>LO2 know the methodology of scientific knowledge; LO 3 to study the achievements of world and Kazakh science in the relevant field; LO 4 to organize, plan and implement the research process; LO 5 analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions; LO 6 analyze and process information from various sources; LO 7 conduct an independent scientific study, characterized by academic integrity, based on modern theories and methods of analysis; LO 8 generate their own new scientific ideas, communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge; LO 9 choose and effectively use modern research methodology; LO 10 plan and predict their further professional development.</p>
13	Education form	Full - time
14	Period of training	3
15	Amount of credits	180
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Master of Engineering and Technology
18	Developer(s) and authors	Alimova K., Serikbayeva Zh., Orazbayeva A.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)									
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CYCLE OF BASIC DISCIPLINES													
University component													
1	Research methods	The course contributes to the formation of knowledge about scientific research, methods and methodology of scientific research, methods of collecting and processing scientific data, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in modern science. The discipline examines the structure of technical sciences, the application of general scientific, philosophical and special methods of scientific research in theory and in practice.	5		v	v	v	v	v				
2	Academic writing	The course is aimed at developing academic writing skills and writing strategies for doctoral students in the field of engineering and natural sciences. The course focuses on the basics and general principles of academic writing for; writing effective sentences and paragraphs; using tenses in scientific literature, as well as styles and punctuation; writing abstracts, introductions, conclusions, discussions, conclusions, literature and resources used; quoting in the text; preventing plagiarism, and making presentations at a conference..	5	v	v	v			v				
3	Pedagogical practice	The purpose of the pedagogical practice of doctoral students is to study the basics of pedagogical and scientific-methodical work in higher educational institutions, mastering pedagogical skills of conducting various types of	10	v		v			v				

		training sessions and preparing teaching materials in fixed disciplines, strengthening motivation for pedagogical work in higher education.												
CYCLE OF BASIC DISCIPLINES														
Component of choice														
4	Modern water supply and sewage systems	Preparation of specialists for design and production and technological activities, installation and construction of utilities and facilities within residential and public buildings; To acquaint the doctoral candidate with ways to increase technical and economic efficiency and improve various methods of modern water supply and drainage systems	5			v		v	v					v
5	Modern gas supply systems of cities and industrial centers	Modern gas distribution systems are a complex of structures consisting of the following main elements: gas ring, dead-end and mixed networks of low, medium and high pressure, laid on the territory of a city or another settlement within blocks and inside buildings; on the mains - gas distribution stations (GDS), gas control points and installations (hydraulic fracturing and GRU), communication systems, automation and remote control. The whole complex of facilities should provide uninterrupted gas supply to consumers.	5				v		v	v	v			v
CYCLE OF PROFILE DISCIPLINES														
University component														
6	Theory and practice of designing modern engineering systems and networks	- the study of the engineering systems of buildings, modern equipment used and the theory of their calculation; - the study of methods of design, reconstruction, modernization of engineering systems of buildings; - the study of the regulatory framework in the design of engineering systems of buildings, equipment selection methods; - design of engineering systems of buildings, ability to choose standard solutions of systems	5	v	v	v							v	v

		and make decisions based on existing standard designs.											
7	Research practice	The doctoral student's research practice is conducted in order to study the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as to consolidate practical skills, apply modern research methods, process and interpret experimental data in a dissertation study	10		v			v		v			
CYCLE OF PROFILE DISCIPLINES													
Component of choice													
8	Optimization of industrial wastewater treatment systems	Gives an idea of the generalization of domestic and foreign experience in the treatment of industrial wastewater from toxic pollutants; analysis and optimization of MPC values of harmful substances in wastewater; theoretical and experimental studies of the process of reagentless precipitation of heavy metal ions and the creation of a data bank on modern technologies for the treatment of industrial wastewater; development of a method for synthesizing technological chains of wastewater treatment; the creation of a rational scheme and the study of the effectiveness of treatment plants in radiator production.	5			v		v	v				v
9	Energy saving systems and equipment in buildings and structures	The discipline "Energy-saving systems and equipment in buildings and structures" gives an idea about energy resources and the principles of their economy, about energy-saving methods in heat-generating installations, in heating and ventilation systems, on the principles of underground coal gasification, on the use of renewable energy resources and energy production at nuclear power plants.	5	v		v	v					v	v

5. Curriculum of educational program



KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATBAYEV



CURRICULUM

of Educational Program on enrollment for 2023-2024 academic year

Educational program 8D07304 - "Engineering systems and networks"
Group of educational programs D127 - "Engineering systems and networks"

Form of study: full-time		Duration of study: 3 years				Academic degree: Doctor of Philosophy (PhD)							
Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount (hours)	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and					
								1 course		2 course			
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester
CYCLE OF BASIC DISCIPLINES (BD)													
M-1. Module of basic training (university component)													
MET322	Research methods	BD UC	5	150	2/0/1	105	E	5					
LNG305	Academic writing	BD UC	5	150	0/0/3	105	E	5					
component of choice													
HYD302	Modern water supply and sewage systems	BD CCH	5	150	2/0/1	105	E	5					
HYD303	Modern gas supply systems of cities and industrial centers												
CYCLE OF PROFILE DISCIPLINES (PD)													
M-2. Module of professional activity (university component)													
HYD301	Theory and practice of designing modern engineering systems and networks	PD UC	5	150	2/0/1	105	E	5					
component of choice													
HYD304	Optimization of industrial wastewater treatment systems	PD, CCH	5	150	2/0/1	105	E	5					
HYD306	Energy saving systems and equipment in buildings and structures												
M-3. Practice-oriented module													
AAP350	Pedagogical practice	BD UC	10						10				
AAP355	Research practice	PD UC	10							10			
M-4. Experimental research module													
AAP336	Research work of the doctoral student, including internships and doctoral dissertation	RWDS UC	5					5					
AAP347	Doctoral student research work, including internship and doctoral dissertation	RWDS UC	40						20	20			
AAP356	Doctoral student research work, including internship and doctoral dissertation	RWDS UC	60								30	30	
AAP348	Research /experimental research work, including internship and doctoral dissertation	RWDS UC	18										18
M-5. Module of final attestation													
ECA303	Writing and defending a doctoral dissertation	FA	12										12
Total based on UNIVERSITY:								30	30	30	30	30	30

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			Total
		university component (UC)	component of choice (CCH)		
BD	Cycle of basic disciplines	20	5		25
PD	Cycle of profile disciplines	15	5		20
Total for theoretical training:		0	35	10	45
	RWDS				123
FA	Final attestation	12			12
TOTAL:		12	35	10	180

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 3 27.10.2022 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 2 21. 10. 2022 y.

Decision of the Academic Council of the Institute "EcoJobalau". Protocol № 2 yoz. " 10 2022 y.

Vice-Rector for Academic Affairs

Dean of the Institute of A&C

Head of the department "Engineering systems and networks"

Representative of the Council of Employers

Head of "EcoJobalau" LLP

[Signatures]

B. Zhautikov

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