MINISTRY OF SCIENCE AND HIGHER EDUCATION
REPUBLIC OF KAZAKHSTAN

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

COMPETENT UNIVERSITY GRADUATE MODEL

according to the educational program

8D07304 Engineering systems and networks

Almaty 2022

Content

1 General information about the educational program 8D07304 Engineering systems and networks

Training of PhD doctors in the educational program 8D07304 Engineering systems and networks is carried out at the Department of Engineering Systems and Networks.

Duration of doctoral studies 8D07304 Engineering systems and networks – 3 years.

Upon graduation from the university, they are awarded the academic degree of Doctor of Philosophy (PhD) in the educational program "Engineering Systems and Networks".

Students who have received education under the educational program 8D07304 Engineering systems and networks are prepared for scientific and pedagogical activities in the field of design solutions, formulating problems and development trends in their professional field, as well as for developing new concepts and studying current problems of modern engineering systems, networks of buildings and structures .

Having acquired professional knowledge in the field of scientific research methods, social aspects of construction activities, having studied global concepts and new paradigms in construction, the graduate is ready for full-fledged and in-depth scientific activity in the chosen scientific direction, as well as for teaching activities at a university.

The educational program adheres to the main international concepts in the field of training engineers:

- ability to create construction projects that meet technical requirements;
- adequate knowledge of construction theory, as well as other technical sciences;
- adequate knowledge in the field of construction of engineering systems and networks, possession of the skills necessary in the process of planning engineering systems;
- understanding the connections between people and structures, and between structures and their environment;
- understanding the importance of the construction profession and the role of engineers in society, in particular when preparing design assignments where social factors must be taken into account;
- understanding of research methods and preparation of assignments for the design of an object;
- understanding of structural design, construction and engineering issues associated with building design;
- adequate knowledge of physical problems and technologies, as well as the functions of buildings in order to provide them with conditions of internal comfort and protection from climatic influences;
- mastering the design skills necessary to meet customer requirements within the constraints of cost factors and building codes;
- knowledge of industries, organizations, regulations and procedures necessary to translate design concepts into actual structures and integrate their plans into the overall layout.

When developing curricula for additional education, the following points should be taken into account:

- awareness of responsibility for humanitarian, social, cultural, urban planning values for the preservation of the environment and the safety of human life;
- adequate knowledge of methods and means of implementing environmentally sustainable design, conservation and rehabilitation of the environment;
- development of competence in the field of construction engineering, based on in-depth knowledge of scientific disciplines and construction methods related to engineering systems of buildings and structures;
- adequate knowledge of project financing, project management, cost control methods and rules for putting a facility into operation;

• development of research skills as an integral part of engineering education, both for doctoral students and teachers.

2 Goals and objectives of the educational program 8D07304 Engineering systems and networks

Purpose of professional activity:

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

Objectives of professional activity:

- study of fundamental and applied issues of engineering systems and networks of buildings and structures;
- studying scientific research methods and applying them in their scientific developments.

Direction of professional activity:

- studying world experience in design and promoting achievements in the field of engineering systems and networks of buildings and structures;
- teaching activities at the university;
- scientific activity in research organizations.

Contents of professional activity:

- organization and planning of project activities, development of normative and regulatory documentation in the field of engineering systems and networks of buildings and structures, teaching activities, scientific activities.

The purpose of 8D07304 Engineering Systems and Networks is to prepare in-demand specialists, with appropriate scientific knowledge and practical skills at all levels of engineering, capable of making strategic decisions to study issues in the field of engineering systems and networks. To do this, the following work is carried out:

- training of professionally competent specialists of a new formation in accordance with the principles of the Bologna Declaration, in demand in the labor market in the field of engineering systems and networks of buildings and structures;
- organization of research work with doctoral students in the field of construction engineering;
- language training for doctoral students.

The objectives of the educational program 8D07304 Engineering systems and networks are:

- development of a system of multi-level training of competitive specialists;
- the formation of an environmentally literate, cultural and socially oriented generation capable of analyzing, predicting and solving modern construction, environmental, and related social problems, stimulating rational use of natural resources, promoting environmental culture and education;
- training through science, the formation of knowledge in the field of life safety and environmental protection, skills and abilities to manage information, strive for continuous improvement of research culture;
- development of subject competencies in the construction and technological field through the formation of knowledge in the field of new innovative technologies, search skills, ability to innovate, initiative and hard work;
- the formation of abilities for controlling activities, the desire for adequate self-esteem and self-control, for fairness and objectivity of assessment;

- development of a specialist in the social sphere with knowledge in the field of human rights (international regulations, legislation of the Republic of Kazakhstan in the field of engineering systems and networks of buildings and structures);

- training of specialists with a high level of professional and moral personality traits.

To achieve the goal of providing quality educational services, the university and the Department of Engineering Systems and Networks, which graduates specialists in the educational program 8D07304 Engineering Systems and Networks, have a modern material and technical base that corresponds to the mission, goals and objectives of the university.

The goals of the EP correspond to the mission, goals and objectives, and available resources of the university. The development of educational technologies and scientific research that meets modern requirements of the scientific and educational process led to the modernization and development of the educational activities of the department.

The entire educational process in the educational program 8D07304 Engineering systems and networks is built on meeting the current problem of engineering systems and networks and forms a specialist in accordance with the requirements of the duties of scientists in the field of engineering systems.

Doctoral training in the educational program 8D07304 Engineering systems and networks (doctoral studies) offers fundamental educational, methodological and research training and in-depth study of disciplines in the following areas of science: modern water supply and sewerage systems, modern gas supply systems for cities and industrial centers, optimization of industrial wastewater treatment systems enterprises, energy-saving systems and equipment in buildings and structures.

3 Principles for ensuring the competitiveness of a specialist

- A competitive specialist is a specialist who meets the needs of the state, society, and the labor market.
- Managing the competitiveness of a specialist is a process carried out by all interested parties - the state, employers, universities, students.
- Responsibility for ensuring the competitiveness of a specialist at a university.
- All interested parties participate in the formation of a specialist - consumers, universities, students on the basis of mutually beneficial relationships.

4 Qualification characteristics of the graduate
Field of professional activity of the graduate

The area of professional activity of graduates includes activities in the field of material and spiritual culture, synthesizing the results and means of science, technology, art, focused on creating a holistic artificial material-spatial environment for comfortable life of a person and society and including:

- research and design (creation, transformation, preservation, adaptation, use) of a harmonious, comfortable and safe artificial environment, and its components, monitoring the implementation of engineering systems and networks projects;

- performing communicative and intermediary functions in relations between the customer, construction contractor, local community and other interested parties in formulating, explaining and promoting design solutions;

- managing the research and design process, organizing the activities of a design company for engineering systems and a network of buildings and structures;

- theoretical understanding, critical analysis and assessment of the prerequisites, methods, results and consequences of engineering systems and networks as a field of knowledge and field of activity, examination of design solutions.

Objects of professional activity of a graduate

The objects of professional activity of a graduate of the educational program are engineering systems and networks with its components (cities, other settlements, buildings and structures, their complexes and fragments - with life support systems, security) and the processes of its modeling, creation and use by people and society.

Objectives of the graduate's professional activity

PhD doctor in the educational program 8D07304 Engineering systems and networks must be prepared to solve professional problems in accordance with the profile focus of the doctoral educational program and types of scientific and pedagogical activities:

design:

- management of the development of projects for the creation, transformation, preservation and long-term development of engineering systems and networks and its components, innovative (conceptual), interdisciplinary and specialized in nature;

research:

- identification and research of applied and fundamental problems in the development of engineering systems and networks, construction activities and development of proposals for their solution;
- management of the development of design assignments of an innovative, conceptual, interdisciplinary and specialized nature;
- conducting pre-design, design and post-design studies of engineering systems and networks;
- compiling reviews and reports on the results of ongoing research; communicative:
- visualization and presentation of design solutions, protection of design materials;
- registration and presentation of the results of scientific research to the academic and professional communities, customers and the public;

organizational and managerial:

- planning, organizing and managing work;
- critical and expert:
- generalization and analysis of experience in the development and implementation of solutions for engineering systems and networks, preparation of reviews of design and research proposals, regulating design materials, control of design documentation;
- preparation of conclusions and assessment of the results of scientific research and scientific and design developments on the problems of engineering systems and networks;

pedagogical:

- implementation of pedagogical activities.

5 Requirements for the development and conditions for the implementation of the main educational training program 8D07304 Engineering systems and networks

Requirements for the development of the main educational program

KazNRTU named after. K.I. Satbayeva independently develops and approves the basic educational program for the preparation of a PhD doctor on the basis of the State Educational Standard.

The educational program complies with regulatory requirements adopted at the national level, working curricula and learning trajectories, curricula of disciplines of the educational program 8D07304 Engineering systems and networks, working curricula of disciplines of the educational program, practice programs, schedules of educational processes and other educational planning documents.

Working curricula developed in accordance with the "Regulations on the development of working curricula", curricula of disciplines of the educational program 8D07304 Engineering systems and networks, working programs of disciplines, practice programs, as well as schedules of educational processes are complete, reflecting the needs of society for specialists in the field of construction engineering .

5.1 Requirements for staffing the educational process

The implementation of the educational program for the preparation of a Doctor of Philosophy (PhD) should be ensured by teaching staff who, as a rule, have a basic education corresponding to the profile of the discipline taught and are systematically engaged in scientific and/or scientific-methodological, creative activities; Teachers of special disciplines, as a rule, must have an academic degree, have the status of licensed laboratories of engineering systems and/or experience in the relevant professional field.

5.2 Requirements for educational and methodological support of the educational process

The educational process for preparing a Doctor of Philosophy (PhD) in the educational program 8D07304 Engineering systems and networks involves scientific research, the tasks and content of which are developed and determined by the goals of preparing a Doctor of Philosophy (PhD).

The content and volume of the information base that provides training for a Doctor of Philosophy (PhD) presupposes the availability and use of scientific, educational, methodological, and professional literature, including periodicals, abstract journals, archival materials, as well as access to various online sources of information.

5.3 Requirements for material and technical support of educational

A higher educational institution implementing the main educational program of the Doctor of Philosophy (PhD) must have a material and technical base that ensures all types of lecture, practical, disciplinary and interdisciplinary training and research work of doctoral students provided for by the curriculum and the relevant current sanitary and technical standards .

5.4 Requirements for organizing practices

To consolidate theoretical material and obtain practical skills in scientific and pedagogical activities, the preparation of a Doctor of Philosophy (PhD) involves the following educational practices: pedagogical and research.

6 Requirements for graduates of the educational program 8D07304 Engineering systems and networks

6.1 General education competencies:

- have basic knowledge in the field of natural sciences (social, humanitarian, economic) disciplines that contribute to the formation of a highly educated personality with a broad outlook;
- have the skills to use information technology in the field of scientific activity;
- possess the skills of acquiring new knowledge necessary for scientific and pedagogical activities and continuation of scientific activities in the future.

6.2 Social and ethical competencies:

- know social and ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities;
- comply with business ethics standards, possess ethical and legal standards of conduct;
- know the basics of the legal system and legislation of Kazakhstan;
- know the trends in social development of society;
- be able to adequately navigate various social situations; - strive for professional and personal growth.

6.3 Economic, organizational and managerial competencies:

- possess the basics of economic knowledge, have scientific ideas about management and marketing in construction activities.

6.4 Special competencies:

A graduate of the educational program 8D07304 Engineering systems and networks is required to:

know:

- socio-economic and political situations in society;
- navigate the prospects for the development of construction science and engineering systems;

be able to:

- independently formulate the latest scientific concepts in the field of engineering systems and related fields of science;

ownmodern means, methods and forms of scientific research.

7 Competencies of a university graduate in the area of training in the educational program 8D07304 Engineering systems and networks

Competency codes	Name of competencies	Brief content/definition and structure of competence Characteristics of the (mandatory) threshold level of competence development for a university graduate	
		Competency structure	**Characteristics of the (mandatory) threshold level of formation**
1	2	3	4
research			
PC-1	Ability to conduct complex applied and fundamental research and conceptually justify new project ideas, solutions and strategies for project actions.	Capable of conducting complex applied and fundamental research;	- distinguishes between fundamental and applied research methods; - applies appropriate methods to carry out its own comprehensive scientific research;
		Able to justify conceptually new project ideas, solutions and strategies for project actions	- recognizes new design ideas and solutions; - suggests the possibility of using new conceptual ideas in practice; -determines the strategy of project actions based on conceptually new project ideas and solutions;
PC-2	The ability to synthesize generalized international experience in the proposed scientific concepts, related to the actual design situation	Able to synthesize generalized international experience in proposed scientific concepts, related to the actual design situation	- compares the proposed scientific concepts with the real design situation; - analyzes international experience in the design of engineering systems and networks; - develops its own scientific position based on existing scientific concepts and generalized international experience.
PK-3	Ability to interpret the results of applied scientific research in the form of generalized design models.	Able to interpret the results of applied scientific research in the form of generalized design models	- classifies the results of applied scientific research; - creates generalized models of project actions; - develops a design plan taking into account the results of applied scientific research
PC-4	The ability to plan, solve and manage the solution of research problems of construction activities in accordance with specialization, the ability to professionally present, justify the results of research developments, develop ways of their implementation in the construction design process	Able to plan, solve and manage the solution of research problems of construction activities in accordance with specialization	- analyzes assigned tasks in accordance with specialization; - develops a plan for the sequence of solving research problems; - manages the solution of research problems within the framework of research and design activities in accordance with specialization
		Able to present professionally and justify the results of research developments	-demonstrates the results of scientific research using professional techniques; -proves the feasibility of the presented research results

		Able to develop ways to implement research solutions into the design process and construction	-evaluates the proposed stages of the design and construction process; -determines ways to introduce research and development into the design and construction process; -chooses ways to implement research developments in design and construction.
PK-5	Ability to conduct a patent search, use the legislative framework for intellectual property protection	Capable of conducting patent searches.	- analyzes existing patent developments; - compares existing patent developments with its own scientific/design product
		Uses the legislative framework for the protection of intellectual property.	-navigates the structure of the legislative framework for the protection of intellectual property; -owns a mechanism for protecting copyrights for scientific/design developments
communicative			
PK-6	The ability to present the results of design work and scientific research at a modern level preparation of presentations, demonstrations, reports, conclusions, abstract reviews, publications and presentation of results to professional and academic communities, governing bodies, customers and the public.	Able to formalize the results of design work and scientific research.	- compiles the existing results of design and scientific research; - evaluates the effectiveness of combinations "method of presentation - type of information"; - illustrates the results of scientific research using innovative methods.
		Able to present the results of design work and scientific research	- demonstrates skills in public presentation of information (including oratory skills, knowledge of professional and scientific vocabulary, the ability to involve listeners in the discussion process); - establishes contact with the audience; - assesses the effectiveness of the impact on communication participants; -authorities, customers and the public).
critical and expert			
PC-11	The ability to summarize, analyze and critically evaluate engineering solutions, draw conclusions, reviews and recommendations for their improvement.	Able to summarize, analyze and critically evaluate engineering solutions.	- knows the mechanisms of critical assessment and engineering solutions;
		Able to draw conclusions, reviews and recommendations for improving engineering systems and networks	- interprets the results of critical assessment in engineering systems and networks;
PC-12	Ability comprehensively analyze and critically evaluate the results of scientific research, compile appropriate reviews and reviews.	Able to comprehensively analyze and critically evaluate the results of scientific research.	-knows the mechanisms of analytical and critical evaluation of scientific research; -analyzes, systematizes and summarizes the results of scientific research
PC-12		Able to write appropriate reviews and reviews.	- formulates his own judgment about the results of scientific activity; - demonstrates one's own judgment in a reasoned manner; - puts into practice the skills of assessing the research activities of other researchers (reviews, feedback).
pedagogical			

PC-13	Ability to transfer experience in the field of engineering systems and carry out teaching activities in educational institutions of higher education.	Capable of transferring experience in the field of engineering systems.	develops a plan for the dissemination/implementation of systematized knowledge, based on various stages of professional training; - experiments with forms/methods of presenting information (innovation); - conveys knowledge, skills, and abilities available in various areas of construction activity.
		Able to carry out teaching activities	- correlates forms and methods of presenting information with categories of students (“consumers”); - - applies independently developed methods in practice; - evaluates the effectiveness of the applied methodology based on monitoring the results;
PK-14	Ability to conduct research and develop innovative methods in the field of engineering systems	Capable of scientific activities	- develops research methodology; - conducts research in the design, construction and operation of engineering systems of buildings and structures; - analyzes the received data; - evaluates the results of the analysis;
		Capable of developing innovative methods in the field of engineering systems	- studies existing methods in construction pedagogy; - selects the most relevant methods of construction pedagogy; - offers an innovative method of presenting information;

8 List of documents used

1. Law of the Republic of Kazakhstan “On Education” dated July 27, 2007 No. 319-Sh; - Law of the Republic of Kazakhstan “On Science” dated February 18, 2011. No. 407-IV;

2. Rules for organizing the educational process in credit education technology, approved by Order of the Minister of Education and Science of the Republic of Kazakhstan No. 563 dated October 12, 2018. (as amended by the order of the Minister of Education and Science of the Republic of Kazakhstan dated 05/06/2021 No. 207);

3. State compulsory standard of higher and postgraduate education, approved by order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022.

4. The European Qualifications Framework (EQF) is a framework that describes a generalized structure of education qualifications at all levels, comparable to national education qualifications systems.

5. Rules for awarding degrees, approved by Order of the Minister of Education and Science of the Republic of Kazakhstan dated March 31, 2011 No. 127 (as amended by Order of the Minister of Education and Science of the Republic of Kazakhstan dated March 9, 2021 No. 98);

6. Rules for credit technology of education at KazNRTU named after. K. I. Satbayeva (PhD) Pr029-03-02-04.01.03.1.06-2022

Head of the department
“Engineering systems and networks” **Alimova K.K.**