

NPJSC «Kazakh national research technical university named after K. I. Satbayev»

**Institute of Architecture and Construction named after T.K. Basenov
Department of "Engineering systems and networks"**

CURRICULUM PROGRAM

8D07304 - «Engineering systems and networks»

**Doctor of philosophy PhD in the educational program
"8D07304-Engineering systems and networks»**


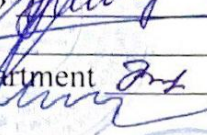
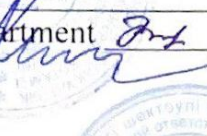
1st edition
in accordance with the SCES of higher education 2018

Almaty 2020

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The program is drawn up and signed by the parties:

From KazNRTU named after K. I. Satbayev:

1. Head of the Department «ESN»  Alimova K.K.
2. Director of Institute  Kuspangaliev B. U.
3. The chairmen of the UMG department  Unaspekov B.A.

From employers:

1. Director of SIC Eco Zhobalau LLP  Zhumartova A.E.

Approved at the meeting of the Educational and methodical Council of the Kazakh national research technical University named after K. I. Satbayev. Protocol No. 4 of 14.01.2020 y.

Qualification:

Level 8 of the National qualifications framework:

Qualifications and positions are determined in accordance with the "Qualification guide of positions of managers, specialists and other employees" approved by order of the Minister of Labor and Social Protection of the Population of the Republic of Kazakhstan dated May 21, 2012 No. 201-p-m (as amended on April 17, 2013). Graduates of the specialty 8D07304 "Engineering systems and networks" are awarded the degree of Doctor of Philosophy (PhD), doctor in the profile.

Professional competence:

The objects of professional activity of doctoral students are:

- with training: state and private design organizations, construction and installation organizations and enterprises, production organizations, and organizations of various organizational and legal forms of the construction industry.
- in scientific and pedagogical training: universities, research institutes, public and private design organizations, construction and installation organizations and enterprises, and organizations of various organizational and legal forms of the construction industry.

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Short description of the 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 doctoral studies, PhD doctoral students can realize all the possibilities for engaging in scientific activities, in particular, they have:

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

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 year

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PASSPORT OF THE EDUCATIONAL PROGRAM

1 Scope and content of the programme

The educational program for the preparation of a Doctor of Philosophy (PhD) has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere.

The educational program for the training of a doctor in the profile assumes fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the branches of the national economy, the social sphere: education, medicine, law, art, economics, business administration and in the field of national security and military affairs.

Educational programs for doctoral studies in terms of vocational training are developed on the basis of studying the experience of foreign universities and research centers that implement accredited training programs for PhD doctors or doctors in the field.

The content of the educational program of specialized doctoral studies is established by the university independently.

The main criterion for the completeness of the educational process for the preparation of doctors of philosophy (PhD) (doctor in the profile) is the mastering of at least 180 academic credits by a doctoral student, including all types of educational and scientific activities.

The term of study in doctoral studies is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a PhD or profile, the doctoral educational program is considered fully mastered.

The training of personnel in doctoral studies is carried out on the basis of educational master's programs in two areas:

- 1) scientific and pedagogical with a training period of at least three years;
- 2) specialized with a training period of at least three years.

The content of the EP

When implementing the educational program of the specialty of postgraduate education 8D07304 "Engineering systems and networks", a credit-modular system of organizing the educational process is used, based on the modular principle of presenting

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the content of the educational program and building curricula, using a system of credits (credits) and relevant educational technologies.

The educational program of the specialty 6D075200 "Engineering systems and networks" contains:

- 1) theoretical training, including the study of cycles of basic and major disciplines;
- 2) additional types of training - various types of practices, research work of a doctoral student, including an internship and a doctoral dissertation;
- 3) intermediate and final attestations.

The implementation of educational programs is carried out on the basis of educational and methodological complexes of the specialty and disciplines.

The total labor intensity of theoretical training is determined by the list of the studied disciplines given in the Working Curriculum.

The main criterion for the completeness of the educational process for the preparation of doctoral students is the development of doctoral students:

- for scientific and pedagogical training - at least 63 credits, of which at least 21 credits of theoretical education, at least 14 credits of practice, at least 27 credits of research work;

One credit is equal to 15 academic hours of the following types of academic work:

- classroom work of a doctoral student throughout the academic period in the form of a semester,
- work of a doctoral student with a teacher during professional and research practices;
- work of a doctoral student with a teacher during the research work of a doctoral student;
- work of a doctoral student on writing a defense of a doctoral dissertation.

Objectives of the educational program:

The main objectives of the educational program, Doctor of Philosophy (PhD) or Doctor of Profile in the specialty 8D07303 "Engineering systems and networks" are:

- ensuring the guarantee of 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;
- streamlining the rights of subjects of educational activity;
- increasing the objectivity and information content of assessing the preparation of doctoral students and the quality of educational programs;
- creating conditions for academic mobility of doctoral students;
- ensuring the functioning of a single educational space in Kazakhstan;
- ensuring the recognition of the documents of the Republic of Kazakhstan on the award of the scientific degree doctor (PhD) or doctor in the field in the international

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educational space and in the international labor market.

2 Requirements for applicants:

Persons with a Master's degree and work experience of at least 1 (one) year or who have completed residency training are admitted to doctoral studies.

Enrollment in the number of doctoral students is carried out by the admissions committees of universities and scientific organizations based on the results of the entrance exam for the groups of doctoral studies and a certificate confirming proficiency in a foreign language in accordance with the common European competences (standards) of foreign language proficiency.

When enrolling in universities, doctoral students independently choose an educational program from the corresponding group of educational programs.

The enrollment of persons for the targeted training of doctors of philosophy (PhD) under the state educational order is carried out on a competitive basis.

The procedure for admitting citizens to doctoral studies is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of the contingent of doctoral students is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for education at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance" the doctoral student must have all the prerequisites necessary for mastering the relevant professional doctoral curriculum. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the doctoral student is allowed to master them on a paid basis. In this case, doctoral studies begin after the doctoral student has fully mastered the prerequisites.

3 Requirements for completing studies and obtaining a diploma

Persons who have mastered the educational program of doctoral studies and defended their 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

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Kazakhstan, based on the results of the examination, are awarded the degree of Doctor of Philosophy (PhD) or Doctor of Science in profile and issued a state diploma with an attachment (transcript).

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

3.1 Requirements for key competencies of doctoral graduates:

1) have an idea:

- about the main stages of development and the change of paradigms 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;
- on the scientific concepts of world and Kazakh science in the relevant field;
- on the mechanism of implementation of scientific developments in practice;
- about the norms of interaction in the scientific community;
- about the pedagogical and scientific ethics of the scientist-researcher;

2) know and understand:

- modern trends, directions and patterns of development of domestic science in the context of globalization and internationalization;
- methodology of scientific knowledge;
- achievements of world and Kazakh science in the relevant field;
- (to understand and accept) the social responsibility of science and education;
- perfect foreign language for scientific communication and international cooperation;

3) be able 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;

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- 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;
- to plan and predict their further professional development;

4) have skills:

- critical analysis, assessment and comparison of various scientific theories and ideas;
- analytical and experimental scientific activities;
- planning and forecasting research results;
- oratory and public speaking at international scientific forums, conferences and seminars;
- scientific writing and scientific communication;
- planning, coordinating and implementing 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 leadership;
- responsible and creative attitude to scientific and scientific-pedagogical activities;
- conducting patent search and experience in transferring 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 conditions of rapid renewal 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;
- in conducting a professional and comprehensive analysis of problems in the relevant area;
- 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 constant professional growth.

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3.2 Requirements for research work of the student on the program of doctor of philosophy (PhD):

1) compliance with the main problems of the educational program of doctoral studies, on which the doctoral dissertation is defended;

2) is relevant and contains scientific novelty and practical significance;

3) is 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) carried out using modern scientific research methods;

6) contains research (methodological, practical) sections on the main protected provisions.

3.3 Requirements for the organization of practices:

The practice is carried out with the aim of developing practical skills in scientific, scientific, pedagogical and professional activities.

The educational program of doctoral studies includes:

1) teaching and research practice - for students of the Ph.D. program;

2) industrial practice - for students under the program of specialized doctoral studies.

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

The research practice of a doctoral student is carried out with the aim of studying the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as consolidating practical skills, applying modern research methods, processing and interpreting experimental data in the dissertation research.

The industrial practice of a doctoral student is carried out in order to consolidate the theoretical knowledge gained in the learning process and improve the professional level.

The content of research and industrial practice is determined by the topic of the doctoral dissertation.

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4 Working curriculum of the educational program

4.1. Duration of training: 3 years

Year of study	Code	Name of discipline	Component	Credits	Lk / lb / pr		Discipline code	C od e	Name of discipline	Component	Cred its	Lk / lb / pr		Discipline code	
1	1 semester						2 semester								
		Research and innovation methodology	BD BK	6				Pedagogical practice			BD	10			
	2202	Elective course	BD KB	6				Research work of the doctoral student, including internships and doctoral dissertation			RWD	24			
		Theory and practice of designing modern engineering systems and networks	MD BK	6											
	2302	Elective course	MD KB	6											
	2303	Elective course	MD KB	6											
		Total:		30				Total:				34			
2	3 semester						4 semester								
		Research work of the doctoral student, including internships and doctoral dissertation	RWD	24				Research work of the doctoral student, including internships and doctoral dissertation			RWD	25			
		Research practice	MD	10											
		Total:		34				Total:				25			
2	5 semester						6 semester								
		Research work of the doctoral student, including internships and doctoral dissertation	RWD	25				Research work of the doctoral student, including internships and doctoral dissertation			RWD	25			
								Writing and defending a doctoral dissertation			FE	12			
		Total:		25				Total:				37			
								Total:				180			

Decision of the Academic Board of Satbaev University. Protocol No. ____ of " ____ " ____ 2020 y.						Number of credits for the whole period of study		
Decision of the Academic Board of the Institute Protocol No. ____ of " ____ " ____ 2020 y.						Cycles of disciplines	Credits	
						The cycle of general education	0	
Vice-Rector for Research and Academic Affairs						D.K. Nauryzbayeva	A cycle of basic disciplines (BD IC, BD OC)	28
Chair of the APC						K.B. Tulegenova	A cycle of principal subjects (PS IC, PS OC)	22
							All on the theoretical classes:	50
Director of the IA&CI						B.U. Kuspangaliyev	MSSR	123
							Registration and defense of the master's thesis (RaDMT)	12
Head of department "ESN"						K.K. Alimova	In TOTAL:	185

5 Modular educational program

The cycle.	Code	Name of disciplines	Semester	Academ. credit.	lecture	lab.	practice	IWS	Type of control	Chair
Profile training module (28 credits)										
Basic disciplines (BD)										
University component										
BD	LNG304	Academic writing	1	6					Exam	EL
BD	GPH318/ MET321	Research methods	1	6					Exam	MPHE &TSM
Choice component										
Research module										
BD 1.3.1	HYD 300	Research and innovation activities methodology	1	6	1	0	2	3	Exam	ESN
BD 1.3.2	HYD 307	Computer modeling of engineering systems								
Practice-oriented module										
BD	AAP350	Teaching practice	2	10					Report	ESN
Major disciplines (MD) (22 credits)										
Choice component										
Module for design studies in the field of engineering systems										
MD 1.1.2	HYD 309	Design and operation of engineering systems for high-rise buildings	1	6	1	0	2	3	Exam	ESN
MD 1.1.2.1	HYD 308	Resource-saving technologies and ecology in construction								
MD 1.1.3	HYD 302	Modern water supply and sewerage systems	1	6	2	0	1	3	Exam	ESN
MD 1.1.3.1	HYD 303	Modern gas supply systems for cities and industrial centers								
MD 1.1.4	HYD 304	Optimization of industrial wastewater treatment systems	1	6	2	0	1	3	Exam	ESN
MD 1.1.4.1	HYD 305	Ventilation and ventilation equipment of the subway								
Practice-oriented module										
MD	AAP349	Research practice	3	10					Report	
Research module (123 credits)										
AKT	AAP345	Research work of a doctoral student, including an internship and the	2	24					Report	ESN

		implementation of a doctoral dissertation								
AKT	AAP345	Research work of a doctoral student, including an internship and the implementation of a doctoral dissertation	3	24					Report	ESN
AKT	AAP346	Research work of a doctoral student, including an internship and the implementation of a doctoral dissertation	4	25					Report	ESN
AKT	AAP346	Research work of a doctoral student, including an internship and the implementation of a doctoral dissertation	5	25					Report	ESN
AKT	AAP346	Research work of a doctoral student, including an internship and the implementation of a doctoral dissertation	6	25					Report	ESN
Final certification module										
FA	ECA303	Registration and defense of a doctoral dissertation	6	12					Protection of dissertations	
Total credits				185						

6 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The third level descriptors within the Comprehensive Qualifications Framework of the European Higher Education Area (EHEA) reflect learning outcomes that characterize the student's abilities:

- 1) demonstrate a systematic understanding of the field of study, mastering the skills and research methods used in this area of engineering systems of buildings and structures;
- 2) demonstrate the ability to think, design, implement and adapt the essential research process with a scientific approach;
- 3) contribute with their own original research to expand the boundaries of the scientific field, which deserves publication at the national or international level;
- 4) critically analyze, evaluate and synthesize new and complex ideas;
- 5) communicate their knowledge and achievements to colleagues, the scientific community and the general public;
- 6) to promote, in an academic and professional context, the technological, social or cultural development of a knowledge-based society.

7 Annex to the certificate according to the standard ECTS

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Annex is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma is required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

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Research and innovation methodology

CODE – HYD 3001

CREDIT – 3 (2/0/1)

PREREQUISITE – mathematics, physics, gas supply, heating, ventilation, heat supply.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Mastering the knowledge and skills necessary to form a systematic understanding of the methodology and methods of scientific research.

SHORT DESCRIPTION OF THE COURSE

- general understanding of the process of scientific research;
- a general understanding of the methods and methodology of scientific research;
- a general idea of the specifics of scientific research
- deepening the skills of conducting scientific research of engineering systems and related fields.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- choice of research direction;
- statement of a scientific and technical problem;
- carrying out theoretical and experimental research;
- recommendations for the presentation of the results of scientific work.

Skills and abilities :

- improvement and development of the general intellectual and general cultural level;
- analysis of scientific problems with the development of a sequence of actions to achieve the intended goal;
- planning of scientific activities, to evaluate and control it, to independently make decisions in the field of management of the organization of scientific research.

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Theory and practice of designing modern engineering systems and networks

CODE – HYD 301

CREDIT – 3 (2/0/1)

PREREQUISITE – gas supply, heating, ventilation, heat supply, water supply.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Mastering knowledge in the field of design and operation of engineering systems of buildings (gas supply, heat supply, ventilation, water supply, sanitation, etc.) in order to calculate them and optimize their work.

SHORT DESCRIPTION OF THE COURSE

- study of the structure of engineering systems of buildings, modern equipment used and the theory of their calculation;
- study of methods of design, reconstruction, modernization of engineering systems of buildings;
- study of the regulatory framework in the field of design of engineering systems of buildings, equipment selection methods;
- design of engineering systems of buildings, the ability to choose standard system solutions and make decisions based on existing standard designs.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- regulatory framework in the field of design and construction of engineering systems of buildings;
- methods of designing engineering systems of buildings and their individual elements, networks and structures, as well as methods of selecting equipment for engineering buildings;
- technology for designing engineering systems of buildings and their individual elements using standard applied calculation and graphic software packages;

Skills and abilities :

- apply existing calculation methods and modern technical solutions in the design of engineering systems of buildings;
- to develop a graphic part of design documentation for engineering systems of buildings;
- methods of organization, improvement and development of new technological processes, adjustment, testing and commissioning of engineering systems of buildings, structures;
- the formation of skills in design, calculation and optimization of the work of engineering systems of buildings using modern methods.

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Modern water supply and sewerage systems

CODE – HYD 302

CREDIT – 3 (2/0/1)

PREREQUISITE – water supply and sewerage, sanitary facilities of buildings.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Acquisition of doctoral students knowledge on modern water supply and drainage systems of buildings; rules for the design of internal water supply and drainage systems for buildings for various purposes, taking into account the peculiarities of architectural and construction solutions and other engineering systems; the rules for the design, laying and construction of utilities of the intra-quarter network.

SHORT DESCRIPTION OF THE COURSE

Training of specialists for design, production and technological activities, installation and construction of engineering communications and structures within residential and public buildings; To acquaint doctoral students with ways to increase technical and economic efficiency and improve various methods of modern water supply and wastewater disposal systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- the main directions and prospects for the development of internal water supply and sewerage systems, elements of these systems, diagrams, methods of designing systems;
- modern equipment for water supply and sewerage systems, trends in its improvement, directions and prospects for the development of this industry.

Skills and abilities :

- select circuit solutions for specific buildings for various purposes,
- use modern methods of design and calculation of internal water supply and sewerage systems.

Own:

- methods of design and calculation of internal water supply and sewerage systems, use modern equipment and installation methods, apply standard solutions

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Modern gas supply systems for cities and industrial centers

CODE – HYD 303

CREDIT – 3 (2/0/1)

PREREQUISITE – heating, ventilation, gas supply, heat supply.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills in the design, construction and operation of modern gas supply systems for cities and industrial centers.

SHORT DESCRIPTION OF THE COURSE

Modern distribution gas supply systems are a complex 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 other settlement within blocks and inside buildings; on the main lines - gas distribution stations (GDS), gas control points and installations (GRP and GRU), communication systems, automation and telemechanics. The entire complex of facilities must ensure uninterrupted gas supply to consumers. The system should provide for the disconnection of its individual elements and sections of gas pipelines for repair and emergency work, it should ensure uninterrupted gas supply to consumers, be simple, safe, reliable and convenient to operate.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- information on the scheme of projects of district planning, master plans of cities, taking into account their development in the future;
- on the gas supply system of industrial enterprises;
- improvement, intensification and automation of technological processes.

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Optimization of industrial wastewater treatment systems

CODE – HYD 304

CREDIT – 3 (2/0/1)

PREREQUISITE – wastewater treatment equipment and technology, water supply and sewerage, wastewater transportation.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to study the patterns of processing of multicomponent industrial wastewater and the formation of automated technologies for their treatment as the basis for managing water protection complexes.

SHORT DESCRIPTION OF THE COURSE

Gives an idea of the generalization of domestic and foreign experience in the purification of industrial wastewater from toxic pollutants; analysis and optimization of MPC values for harmful substances in wastewater; theoretical and experimental studies of the processes of reagent-free precipitation of heavy metal ions and the creation of a data bank on modern technologies for industrial wastewater treatment; development of a method for the synthesis of technological chains of wastewater treatment; creation of a rational scheme and study of the effectiveness of treatment facilities in radiator production.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- Methodology for optimizing the MPC values for harmful substances in wastewater.
- Method and software for the synthesis of technological chains of wastewater treatment.
- Technological scheme of catholyte-sorption wastewater treatment, as a result of exploratory design.
- Evaluation of the effectiveness of the cleaning system.

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Ventilation and ventilation equipment of the subway

CODE – HYD 305

CREDIT – 3 (2/0/1)

PREREQUISITE – Ventilation and ventilation equipment of the subway

THE PURPOSE AND OBJECTIVES OF THE COURSE

The goal is to study the design, operation of modern ventilation and heat supply systems for subways and underground structures.

SHORT DESCRIPTION OF THE COURSE

Gives an idea of the main structures and engineering systems of the subway and underground structures. Mastering the knowledge and skills necessary for the metrological foundations of measurement; implementation of design solutions in the construction of engineering systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- methodology for aerodynamic calculations of tunnel ventilation systems;
- calculations of air-thermal curtains in tunnels, entrances and exits of metro lobbies;
- the main engineering equipment in the metro structures;
- thermal effect of underground stations and shallow underground tunnels on the surrounding soil;
- a methodology for determining the area of influence of underground structures of subways on the temperature of the surrounding soil masses;
- activities related to the provision of microclimate and the choice of operating modes for tunnel ventilation (depending on climatic conditions);
- arrangement of heat pump systems and their effective application to metro facilities;

Skills and abilities :

- to carry out heat engineering calculations of subway tunnels;
- calculate the ventilation system of subways;
- resolve issues related to improving the energy efficiency of metro facilities;
- to substantiate the prospects of using heat pumps to stabilize the thermal regime and parameters of the internal microclimate at stations and in metro lobbies.
- to draw up a mathematical model describing the processes of changing the temperature of the soil mass surrounding underground stations and subway tunnels, taking into account seasonal fluctuations in atmospheric air.

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Energy-saving systems and equipment in buildings and structures

CODE – HYD 306

CREDIT – 3 (2/0/1)

PREREQUISITE – mathematics, physics, chemistry, hydraulics and aerodynamics, heat and mass transfer, heat generating units, heating and ventilation

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills in the design, construction and operation of buildings and structures using energy-saving systems and equipment

SHORT DESCRIPTION OF THE COURSE

The discipline "Energy-saving systems and equipment in buildings and structures" gives an idea about energy resources and the principles of their saving, about methods of energy saving in heat-generating installations, in heating and ventilation systems, about the principles of underground gasification of coal, about the use of renewable energy resources, about the energy-technological use of waste and energy production at nuclear power plants.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- classification of energy resources;
- the structure of the energy balance;
- general principles of saving fuel and energy resources;
- a list of measures to save fuel and energy resources in heat generating installations and the principles of their implementation;
- methods and means of energy saving in heating systems;
- methods of utilizing the heat of air removed by ventilation systems;
- general principles of energy technology use of agricultural, urban and industrial waste;
- methods of underground coal gasification;
- options for energy technological processing of low-grade fuels;
- principles of using solar energy, geothermal energy and wind energy;
- basics of energy production at nuclear power plants and nuclear power plants;
- economic aspects of the use of energy-saving technologies;

Skills and abilities :

- to assess the economic feasibility of using energy-saving technologies;
- to evaluate the effectiveness of energy saving measures in heat generating installations;
- develop measures to save energy in heating systems;

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- to calculate the systems for utilization of the heat of the air removed from the premises and to select the equipment for heat recovery installations;
- to develop systems of geothermal heat supply and perform calculations of solar installations.

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Computer modeling of engineering systems

CODE – HYD 307

CREDIT – 3 (2/0/1)

PREREQUISITE – sanitary engineering of buildings, water transportation, heat supply.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The goal of teaching the discipline is to form a holistic understanding of new computer calculations in the study of engineering systems among doctoral students.

SHORT DESCRIPTION OF THE COURSE

The discipline "Computer modeling of engineering systems" gives an idea of the basic concepts and methods of computer modeling in engineering systems used in urban construction and economy. Formation of the skills of doctoral students to independently solve problems arising in the design, construction and operation of buildings and urban facilities using BIM technologies in engineering systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- concepts and methods of using specialized software systems that implement modern computer technologies in engineering systems for solving exploration and design problems;
- scientific and technical information, domestic and foreign experience in the use of BIM technologies in engineering systems for solving practical problems;
- methods and means of computer modeling of buildings, structures and urban areas;

Skills and abilities :

- to use specialized software systems that implement computer technologies in engineering systems for solving exploration and design problems;

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Resource-saving technologies and ecology in construction

CODE – HYD 308

CREDIT – 3 (2/0/1)

PREREQUISITE – mathematics, chemistry, building materials, water chemistry and microbiology.

THE PURPOSE AND OBJECTIVES OF THE COURSE

To give theoretical and practical knowledge in the field of resource-saving technologies in construction.

SHORT DESCRIPTION OF THE COURSE

Resource saving is a set of measures for the thrifty and efficient use of the facts of production (capital, land, labor). Provided through the use of resource-saving and energy-saving technologies; reducing the capital intensity and material consumption of products; increasing labor productivity; reducing the cost of living and materialized labor; improving product quality; rational use of labor of managers and marketers; use of the benefits of the international division of labor, etc. Promotes the growth of the economy's efficiency, increasing its competitiveness.

Resource-saving technologies - technologies that ensure the production of products with the minimum possible consumption of fuel and other energy sources, as well as raw materials, materials, air, water and other resources for technological purposes.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- rational use of materials and energy resources both during construction and during the operation of the building;
- ecological cleanliness, minimization of negative impact on human health and nature;
- the comfort of living or working in the constructed building.
- basic terms and definitions in the field of resource-saving technologies in construction;

Skills and abilities :

- to assess the rationality of the use of material, energy and water resources in construction;

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Design and operation of engineering systems for high-rise buildings

CODE – HYD 309

CREDIT – 3 (2/0/1)

PREREQUISITE – heating, ventilation and air conditioning, water supply and sewerage.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Mastering the knowledge and skills necessary for the design of engineering systems for high-rise buildings, understanding the specifics of processes in high-rise buildings.

SHORT DESCRIPTION OF THE COURSE

Design of heating, ventilation, air conditioning, water supply and sewerage systems for high-rise buildings, study of building aerodynamics and development, environmental protection issues, conservation of various kinds of energy in a finished project.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline doctoral students should:

Know:

- issues related to the design and operation of engineering systems of buildings and structures;
- all stages of design and preparation of construction documentation;

Skills and abilities :

- define design criteria and description of engineering systems;
- to carry out the choice of engineering equipment during the operation of the building;

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Defense of doctoral dissertation

CODE – ECA303

CREDIT – 4

The purpose of the doctoral dissertation is to assess the scientific-theoretical and research-analytical level of the doctoral student, the formed professional and managerial competencies, the readiness to independently perform professional tasks and the compliance of its preparation with the requirements of the professional standard and the educational program of doctoral studies.

SHORT DESCRIPTION

Doctoral dissertation is a scientific work of a doctoral student, which is an independent study, in which theoretical provisions are developed, the totality of which can be qualified as a new scientific achievement, or a scientific problem is solved, or scientifically grounded technical, economic or technological solutions are stated, the implementation of which makes a significant contribution to development the country's economy.

A doctoral dissertation is the result of the research / experimental research work of a doctoral student, carried out during the entire period of study of a doctoral student. The defense of a doctoral dissertation is the final stage in the preparation of a doctoral candidate. A doctoral dissertation must meet the following requirements:

- The topic of the dissertation should be related to priority areas of development of science and / or government programs or programs of fundamental or applied research.
- The content of the thesis, the goals and objectives, the scientific results obtained must strictly correspond to the topic of the thesis.
- The dissertation is carried out in compliance with the principles of independence, internal unity, scientific novelty, reliability and practical value.

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