

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

**7M07304 - "Engineering systems and networks"
(scientific and pedagogical direction (2 y.)**

**7M07304 – "Engineering systems and networks"
Master of technical sciences**

1st edition



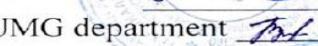
in accordance with the SCES of higher education 2018

Almaty 2020

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

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  Kuspangaliyev 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. Satpayev. Protocol No. 4 of 14.01.2020 y.

Qualification:

Level 7 of the National qualifications framework:

7M07 Engineering, manufacturing and construction industries:

7M073 Architecture and construction:

7M07304-Engineering systems and networks (master's degree)

Professional competence:

Master's graduate can work as a Manager of project work, carry out managerial activities, in research institutes, laboratories, universities, teaching, designer of plumbing systems and networks of buildings and structures; the use of information technology in the field of engineering systems and networks of buildings and structures.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Brief description of the program:

Within the framework of the Master's degree program, the university independently develops various educational programs in accordance with the National Qualifications Framework, professional standards and agreed with the Dublin descriptors and the European Qualifications Framework.

Educational programs should be focused on learning outcomes.

Dublin descriptors, which are a description of the level and amount of knowledge, abilities, skills and competencies acquired by undergraduates at the end of the educational program of each level (stage) of higher and postgraduate education, are based on learning outcomes, competencies formed, as well as the total number of credit (credit) units ECTS.

The structure of the master's educational program is formed from various types of educational and scientific work that determine the content of education, and reflects their ratio, measurement and accounting.

The purpose of the educational program is to achieve the provision of high quality educational services in the field of postgraduate education, leadership in the national space for training personnel in the specialty 6M075200 "Engineering systems and networks" through the implementation of the principles of the Bologna process and modern quality standards.

The objective of the educational program is to train highly qualified competent specialists in the construction and engineering sector of the economy of the Republic of Kazakhstan, capable of quickly adapting to rapidly changing market conditions and innovative trends.

The list of disciplines of the optional component is determined by the university independently. This takes into account the expectations of employers and the needs of the labor market.

Masters of the specialty 6M075200 "Engineering systems and networks" can perform the following types of professional activities:

- Calculation and design and technical and economic;
- organizational and managerial;
- production, technological and operational;
- legal, expert and consulting
- research;
- educational (pedagogical).

Specific activities are determined by the content of the educational and professional program developed by the university.

Organizational and managerial activities:

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

- organization of the work of the performers' labor collective with the creation of the necessary conditions, equipping (providing) production with labor and material resources, making optimal management decisions in various production conditions;
- finding optimal solutions in the event of labor disputes on the staffing table, wages, cost and quality of various types of work, ensuring life safety, labor protection and environmental safety in industrial areas;
- assessment of production and non-production costs to ensure the quality of products of construction and repair production;
- implementation of technical control and quality management in transport construction.

Production, technological and operational activities:

- planning and solution of technological problems encountered in the production process;
- effective use of materials and raw materials, equipment, technology, modern computer programs for calculations and design of technological process parameters;
- engineering and technical maintenance of buildings and structures of industrial and civil construction or engineering systems.

Production, technological and operational activities:

- planning and solution of technological problems encountered in the production process;
- effective use of materials and raw materials, equipment, technology, modern computer programs for calculations and design of technological process parameters;
- engineering and technical maintenance of buildings and structures of industrial and civil construction or engineering systems.

Legal, expert and consulting activities:

- possession of basic knowledge in the field of civil, financial, commercial and other branches of law;
- the ability to navigate the current legislation and the ability to apply certain legal norms in practice;
- carrying out expertise and providing consulting assistance in various production situations.

Educational (pedagogical) activities:

- possession of the functions of teaching courses in basic disciplines, technology, organization, planning and management of engineering systems, performance of educational work as a teacher (teacher) in institutions of secondary and vocational education (schools, gymnasiums, lyceums, colleges).

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

PASSPORT OF THE EDUCATIONAL PROGRAM

1 Scope and content of the program

The term of study in the master's program 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 master's degree, the master's educational program is considered fully mastered. In the scientific and pedagogical magistracy, at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master student.

The planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of the credit technology of education.

The master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the preparation of scientific and scientific and pedagogical personnel for universities and scientific organizations with in-depth scientific, pedagogical and research training.

The content of the Master's degree program consists of:

- 1) theoretical training, including the study of cycles of basic and major disciplines;
- 2) practical training of undergraduates: various types of practices, scientific or professional internships;
- 3) research work, including the implementation of a master's thesis - for a scientific and pedagogical magistracy
- 4) final certification.

The content of the EP

When implementing the educational program of the specialty of postgraduate education 7M07304 "Engineering Systems and Networks", a credit-modular system for organizing the educational process is used, based on the modular principle of presenting 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 7M07304 "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, experimental research / research work;
- 3) intermediate and final attestations.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

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 masters is the development of master students:

- for scientific and pedagogical training - at least 59 credits, of which at least 42 credits of theoretical education, at least 6 credits of practice, at least 7 credits of research work;

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

- classroom work of a master student throughout the academic period in the form of a semester,

- Master's student's work with a teacher during the period of professional and research practices;

- work of a master student with a teacher during the period of research work (experimental research) work of a master student;

- Master's student's work on writing a master's thesis defense;

- Master's student's work on preparation and passing of a comprehensive exam.

The previous level of education is higher education.

Opportunities for continuing education: the master, who has mastered the educational program of the master's program, is prepared for continuing education in **doctoral studies** in the specialty "8D07304- Engineering systems and networks".

A summary table reflecting the volume of disbursed loans in the context of modules of the educational program of the specialty 7M07304 "Engineering systems and networks" is given in Table 1.

Table 1

The volume of disbursed credits in the context of modules of the educational program of the specialty 7M07304 "Engineering systems and networks" scientific and pedagogical direction (study period 2 years)

Course of Study	Semester	Number of mastered modules	Number of disciplines studied	Number of KZ credits	Total (hour)	ECTS	Quantity

		es	M C	PC	Theoreti cal teaching	ERW M	Pedagogi cal practice	Final examin ation	Tota l			Ex.	Cours e projec t/ work, report
1	1	2	0	6	14	-	-	-	14	840	22	6	-
	2	4	3	2	14	2	3	-	19	114 0	44	5	2
2	3	4	0	5	14	2	3	-	19	114 0	44	5	2
	4	2	-	-	-	3	-	4	4	240	27	1	1
TOTAL		12	3	13	42	7	6	4	56	336 0	137	17	5

Objectives of the educational program:

The main objectives of the Master's degree program in the specialty -7M07304 "Engineering systems and networks" are:

- training of scientific and pedagogical personnel for work, regardless of the form of ownership and subordination: in organizations of higher and secondary vocational education; in research and design institutions; in the office; in companies, firms and organizations (enterprises) of construction and other infrastructures of the economy;

2 Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for the admission of citizens to the magistracy 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 a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training 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", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

3 Requirements for completing studies and obtaining a diploma

Awarded degree / qualifications: The graduate of this educational program is awarded the academic degree "Master of Engineering" in the direction.

A graduate who has mastered master's programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities;
- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern scientific and technical equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- possession of the skills of compiling and preparing scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness to communicate in oral and written forms in a foreign language to solve problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activity that the master's program is focused on:

research activities:

- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained during the master's program;
- the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of engineering systems of buildings and structures;

research and production activities:

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

- the ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;
- the ability to professionally operate modern field and laboratory equipment and instruments in the field of the mastered master's program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;

project activities:

- the ability to independently compose and submit projects of research and development work;
- readiness to design complex research and development work in solving professional problems;

organizational and management activities:

- the willingness to use the practical skills of organizing and managing research and development work in solving professional problems;
- readiness for the practical use of regulatory documents in the planning and organization of scientific and industrial work;

scientific and pedagogical activity:

- the ability to conduct seminars, laboratory and practical classes;
- the ability to participate in the management of scientific and educational work of students in the field of engineering systems of buildings and structures.

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

4 Working curriculum of the educational program

4.1. Duration of training 2 years

year of study	Code	Name of course	Component	Academic credits	lecture/laboratory/practice/MSIW	Prerequisites	Code	Name of course	Component	Academic credits	lecture/laboratory/practice/IWS	Prerequisites
1	1 semester						2 semester					
	LNG202	Foreign language (professional)	BD IC	6	0/0/3/3		AAP244	Pedagogical practice	BD IC	4	0/0/2/2	
	HUM204	Management psychology	BD IC	4	1/0/1/2		HUM201	History and philosophy of science	BD OC	4		
	HYD207	Methods for calculating the energy efficiency of buildings and structures	BD IC	6	1/0/1/2		HUM207	Higher school pedagogy	BD OC	4		
	1101	Optional component BD	BD IC	6	1/0/1/2		HYD226	Means and methods of experimental research	PS IC	6		
	1102	Optional component BD	BD OC	6				Institutional component PS	PS IC	6		
	1202	Institutional component PS	PS IC	6			AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6		
	AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6								
	In total		40				In total		30			
2	3 semester						4 semester					
		Optional component PS	PS OC	6			AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6		
		Optional component PS	PS OC	6			AAP236	Research scientific training	PS	7		
		Optional component PS	PS OC	6			ECA205	Registration and defense of the master's thesis (RaDMT)	FA	12		
		Optional component PS	PS OC	6								
	AAP242	Master's student scientific research, including an internship and a master's thesis.	MSSR	6								
	In total		30				In total		25			
							In all		125			

Number of credits for the whole period of study		
Cycles of disciplines	Credits	
The cycle of general education	0	Decision of the Academic Board of Satbaev University. Protocol No. ___ of "___" ____
A cycle of basic disciplines (BD IC, BD OC)	40	
A cycle of principal subjects (PS IC, PS OC)	49	Decision of the Academic Board of the Institute _____ Protocol No. ___ of "___" ____
All on the theoretical classes:	89	
MSSR	24	Vice-Rector for Research and Academic Affairs D.K. Naurzybayeva
Registration and defense of the master's thesis (RaDMT)	12	Chair of the APC K.B. Tulegenova
In total	125	Director of the Institute B.U. Kuspangaliyev
		Head of the Department K.K. Alimova

THE CATALOG OF ELECTIVE DISCIPLINES

of the Educational program "Engineering systems and networks"

Specialty 7M07304 - "Engineering systems and networks"

Study period: 2 years

Year of study	Elective Curriculum Code	Discipline Code	Name of disciplines	Cycle	Credits	lek / lab / pr	Semester
1	2205	HYD 248	Innovative technologies for natural and waste water treatment	B	6	2/0/1/ 3	1
		HYD 249	Heat generators and autonomous heating of buildings				1
	2207	HYD 250	Innovative design solutions for water supply and sewerage systems and structures	B	6	2/0/1/ 3	2
		HYD 251	Effective eco-friendly technologies in heat and gas supply and ventilation systems				2
	2208	HYD 258	Modern technologies and equipment for water supply and sewerage systems	B	6	2/0/1/ 3	2
		HYD 259	Methods for optimizing the parameters of heat and gas supply systems and heat generating plants				2
	2303	HYD 255	Retechnology of wastewater treatment plants	P	4	1/0/1/ 2	2
		HYD 208	Adjustment of heating, ventilation and air conditioning systems				2
	2304	HYD 263	Methods and tools for studying water purification processes	P	6	2/0/1/ 3	2
		HYD 264	Regulation of heat supply in heat supply systems				2
	3305	HYD 219	Water protection systems	P	6	2/0/1/ 3	3
		HYD 225	Saving heat and energy in heat and gas supply and ventilation systems				3
	3306	HYD 253	Modern computer calculations of heat and gas supply and ventilation systems	P	6	2/0/1/ 3	3
		HYD 252	Modern computer calculations of water supply and sewerage systems				3
2	3307	HYD 254	Modern methods of modernization of water treatment facilities	P	4	1/0/1/ 2	3
		HYD 207	Adjustment and reconstruction of heat supply systems				3
	3308	HYD 261	Organization, planning and management of water supply and sewerage enterprises	P	4	1/0/1/ 2	3
		HYD 262	Normative legal regulation of the design of heat and gas supply and ventilation systems				3
	3309	HYD 256	Actual problems of the operation of modern water supply and sewerage systems	P	4	1/0/1/ 2	3

		HYD 257	Actual problems of the operation of modern heat and gas supply and ventilation systems			3
		Total:			26	

5 Modular educational program

The cycle	Code	Name of disciplines	Semester	Academ credit.	lecture	lab.	practice	IWS	Type of control	Chair
Profile training module										
Basic disciplines (BD) (35 credits)										
University component (UC) (22credits)										
BD 1.1.1	LNG20 2	Foreign language (professional)	1	6	0	0	3	3	Exam	EL
BD 1.2.1	HUM2 01	History and philosophy of science	1	4	1	0	1	2	Exam	SD
BD 1.3.1	HUM2 07	Higher school pedagogy	2	4	1	0	1	2	Exam	SD
BD 1.4.1	HUM2 04	Management psychology	2	4	1	0	1	2	Exam	SECRM
Practice-oriented module										
	AAP23 6	Teaching practice	2	4					Report	ESN
Choice component (18 credits)										
Module of technical										
BD 1.1.6	HYD 248	Innovative technologies for natural and waste water treatment	1	6	2	0	1	3	Exam	ESN
BD 1.1.6.1	HYD 249	Heat generators and autonomous heat supply of buildings								
BD 1.1.8	HYD 258	Modern technologies and equipment of water supply and sewerage systems	1	6	2	0	1	3	Exam	ESN
BD 1.1.8.1	HYD 259	Methods for optimizing the parameters of heat and gas supply systems and heat generating plants								
BD 1.1.7	HYD 250	Innovative design solutions for water supply and sewerage systems and structures	2	6	2	0	1	3	Exam	ESN
BD 2.1.3.1	HYD 264	Regulation of heat supply in heat supply systems								
Major disciplines (MD) (49 credits)										
University component (UC)										
MD	AAP23 6	Research practice	4	7					Report	ESN
Scientific and methodological training module										
PS 1.1.9.1	HYD 260	Methods for calculating the energy efficiency of buildings and structures	1	6	2	0	1	3	Exam	ESN
PS 2.1.3	HYD22 6	Means and methods of experimental research	2	6	2	0	1	3	Exam	ESN
Component of choice (CC)										
Engineering systems and structures module										
PS	HYD 255	Reconstruction of wastewater treatment	1	6	2	0	1	3	Exam	ESN
Designed by:			Reviewed: meeting of the Academic Council of the Institute			Approved by: Educational and methodological council of KazNRTU			Page 1 of 50	

2.2.4		facilities								
PS 2.2.4.1	HYD 208	Start-up and adjustment of water supply and sewerage facilities								
PS 2.2.1	HYD 219	Systems of protection of water resources+C33:C40C2C33:C40	3	6	2	0	1	3	Exam	ESN
PS 2.2.1.1	HYD 225	The economy of heat and energy in heat and gas supply and ventilation systems								
PS 2.2.2	HYD 253	Modern computer calculations of heat supply, gas supply and ventilation systems	3	6	2	0	1	3	Exam	ESN
PS 2.2.2.1	HYD 252	Modern computer calculations of water supply and sewerage systems								
PS 2.2.3	HYD 254	Modern methods modernization of water treatment facilities	3	6	2	0	1	3	Exam	ESN
PS 2.2.3.1	HYD 207	Adjustment and reconstruction of heat supply systems								
PS 2.2.5	HYD 256	Actual problems of operation of modern water supply and sewerage systems	3	6	2	0	1	3	Exam	ESN
PS 2.2.5.1	HYD 257	Actual problems of operation of modern systems of heat supply, gas supply and ventilation								
Major disciplines (MD)										
PS	AAP23 6	Work placement	4	7					Report	ESN
Experimental research module (24credits)										
MSER W	AAP24 2	Master's student experimental research work, including internship and master's project implementation	1	6					Report	ESN
MSER W	AAP24 2	Master's student experimental research work, including internship and master's project implementation	2	6					Report	ESN
MSER W	AAP24 2	Master's student experimental research work, including internship and master's project implementation	3	6					Report	ESN
MSER W	AAP24 2	Master's student experimental research work, including internship and master's project implementation	4	6					Report	ESN
Final certification module (12 credits)										
FA	ECA20 5	Registration and defense of the master's thesis	4	12					Defense of dissertatio ns	
Total credits				125						

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

The requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's degree) and reflect the acquired competencies expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) Demonstrate developing knowledge and understanding in the field of engineering systems of buildings and structures, based on advanced knowledge in engineering, while developing and applying ideas in the context of research;

2) apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a broader interdisciplinary context;

3) collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;

5) learning skills necessary for independent continuation of further education in the studied area of engineering systems of buildings and structures.

7 Completion Competencies

7.1 Requirements for the key competencies of graduates of the *scientific and pedagogical magistracy* must:

1) *have an idea:*

- about the role of science and education in public life;

- about current trends in the development of scientific knowledge;

- on topical methodological and philosophical problems of natural (social, humanitarian, economic) sciences;

- about the professional competence of a higher school teacher;

- about the contradictions and socio-economic consequences of globalization processes;

2) *know:*

- methodology of scientific knowledge;

- principles and structure of the organization of scientific activity;

- psychology of cognitive activity of undergraduates in the learning process;

- psychological methods and means of increasing the efficiency and quality of education;

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

3) *be able to:*

- use the knowledge gained for the original development and application of ideas in the context of scientific research;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- to integrate the knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;
- to apply the knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- think creatively and be creative in solving new problems and situations;
- be fluent in a foreign language at a professional level, allowing for research and teaching of special disciplines at universities;
- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc .;

4) *have skills:*

- research activities, solving standard scientific problems;
- implementation of educational and pedagogical activities on credit technology of education;
- methods of teaching professional disciplines;
- the use of modern information technologies in the educational process;
- professional communication and intercultural communication;
- oratory, correct and logical design of your thoughts in oral and written form;
- expanding and deepening the knowledge required for daily professional activities and continuing education in doctoral studies.

5) *be competent:*

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activities in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;
- in ways to ensure constant updating of knowledge, expanding professional skills and abilities.

B Basic knowledge, abilities and skills:

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

B1. Possess basic knowledge in the field of natural science (social, humanitarian, economic) disciplines that contribute to the formation of a highly educated personality with a broad outlook and culture of thinking;

B2 - have the skills to use information technologies in the field of engineering systems of buildings and structures;

B3 - possess the skills of acquiring new knowledge necessary for professional activity and continuing education in the magistracy.

P Professional competence:

P1 Able to logically represent the acquired knowledge and understanding of systemic relationships within disciplines, as well as interdisciplinary relationships in modern science.

P2 Able to build technologies for teaching new knowledge.

P3 Possession of approaches and methods of critical analysis, the ability to practically use in relation to various forms and processes of modern society.

P4 Ability for expert assessment of the quality of research and types of professional activities.

P5 Willingness to work independently, ability to manage your time, plan and organize activities.

P6 Readiness for continuous self-development, the ability to build strategies for personal and professional development of education.

P7 Able to determine the operating modes of the equipment of engineering systems and networks.

P8 Able to calculate and select equipment for engineering systems and networks.

P9 Able to properly and safely operate the equipment of engineering systems and networks.

P10 Able to independently master new equipment, technological and technical documentation.

P11 Skills in the design of engineering systems and networks.

P12 Knowledge of the requirements of the Rules of safety, labor protection and protection of the environment from the harmful effects of production and the ability to use them in practice.

P13 Knowledge of energy and resource saving technologies and the ability to apply them in engineering systems.

P14 Knowledge of means and methods of experimental research.

P15 Ability to simulate the operation of engineering systems, networks and their equipment.

P16 Knowledge of the basics of operation of engineering systems, networks and their equipment.

P17 Be proficient in a professional foreign language.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

P18 Ability to analyze in the field of project management and business.

P19 Knowledge of the theoretical foundations of the processes occurring in engineering systems.

P20 Knowledge of experimental research planning methods.

About Human, social and ethical competences:

O1 Mastering the historical foundations of the state and philosophical essences of the universe and humanity

O2 Proficiency in a professional foreign language at the level necessary for the possession of scientific and technical information on the specialty being mastered

O3 Knowledge and understanding of professional ethical standards, mastery of professional communication techniques. Ability to build interpersonal relationships and work in a group (team)

O4 Possession of pedagogical skills and mastering the methodological techniques necessary for teaching special disciplines in higher and secondary technical educational institutions.

C Special and management competencies:

C1 to have the skills of professional communication and intercultural communication, oratory, correct and logical formulation of their thoughts in oral and written form

C2 be able to economically substantiate and solve issues related to the organization of the production process, determine the volume and quality indicators of the operation of engineering systems, process and analyze the results of theoretical and experimental studies on the technical level and operational state of engineering systems and structures

C3 to have the skills of risk management using traditional and modern technologies based on the application of the methodology for constructing models of risk representation in the field of engineering systems, analysis and comparison of risk alternatives; be able to navigate freely in applied work on the analysis and management of risks in supply chains, manage conflicts and know business ethics

C4 to be able to competently make independent decisions based on the knowledge gained for subsequent practical justifications aimed at improving the functioning of the construction industries of engineering systems of buildings and structures.

C5 to be able to make optimal management decisions in various conditions, to have knowledge of the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

C6, possess the skills of acquiring new knowledge, expanding and deepening knowledge necessary for daily professional activities and continuing education in doctoral studies, be capable of self-improvement and personal growth.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

7.2 Requirements for the research work of a master student in a scientific and pedagogical master's degree:

- 1) corresponds to the profile of the master's educational program, according to which the master's thesis is carried out and 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) carried out using modern scientific research methods;
- 5) contains research (methodological, practical) sections on the main protected provisions;
- 6) is based on advanced international experience in the relevant field of knowledge.

7.3 Requirements for organizing practices:

The educational program of the scientific and pedagogical magistracy includes two types of practices that are conducted in parallel with theoretical training or in a separate period:

- 1) pedagogical in the MD cycle - at the university;
- 2) research in the PD cycle - at the place of the dissertation.

Pedagogical practice is carried out with the aim of developing practical skills in teaching and learning methods. At the same time, undergraduates are involved in conducting classes in a bachelor's degree at the discretion of the university.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

8 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).

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

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.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Foreign language (professional)

CODE – LNG205

CREDIT – 3 (0/0/3)

PREREQUISITE – LNG201

THE PURPOSE AND OBJECTIVES OF THE COURSE

Thanks to this, undergraduates will master specific terminology, be able to read specialized literature, gain the knowledge necessary to implement effective oral and written communication in a foreign language in their professional activities.

BRIEF DESCRIPTION OF THE COURSE

In the process of training, students acquire knowledge of a foreign language, including proficiency in specialized vocabulary, necessary for the implementation of effective oral and written communications in a foreign language in their professional activities. Practical tasks and methods for developing the required language skills in the learning process include: case method and role-playing games, dialogues, discussions, presentations, listening tasks, working in pairs or in groups, completing various written tasks, grammar tasks and explanations.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of mastering the discipline, the undergraduate expands the professional vocabulary, masters the skills of effective communication in a professional environment, the ability to competently express thoughts in oral and written speech, understand specific terminology and read specialized literature.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

History and philosophy of science

CODE – HUM201

CREDIT – 2(1/0/1)

PREREQUISITE - HUM124

THE PURPOSE AND OBJECTIVES OF THE COURSE

- to reveal the connection between philosophy and science, to highlight the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of the philosophy of science, modern problems of the development of scientific and technical reality.

BRIEF DESCRIPTION OF THE COURSE - subject of philosophy of science, dynamics of science, specificity of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, technology and technology, specificity of engineering sciences, ethics of science , social and moral responsibility of a scientist and engineer.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE - know and understand the philosophical issues of science, the main historical stages in the development of science, the leading concepts of the philosophy of science, be able to critically assess and analyze scientific and philosophical problems, understand the specifics of engineering science, possess the skills of analytical thinking and philosophical reflection, be able to substantiate and defend one's position, master techniques conducting discussion and dialogue, possessing the skills of communication and creativity in their professional activities.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Higher education pedagogy

CODE - HUM205

CREDIT 2(1/0/1)

PREREQUISITE - HUM124

THE PURPOSE AND OBJECTIVES OF THE COURSE

The course is aimed at studying the psychological and pedagogical essence of the educational process in higher education; formation of ideas about the main trends in the development of higher education at the present stage, consideration of the methodological foundations of the learning process in higher education, as well as psychological mechanisms affecting the success of learning, interaction, management of subjects of the educational process. Development of psychological and pedagogical thinking of undergraduates.

BRIEF DESCRIPTION OF THE COURSE

In the course of studying the course, undergraduates get acquainted with the didactics of higher education, forms and methods of organizing education in higher education, psychological factors of successful learning, features of psychological influence, mechanisms of educational influence, pedagogical technologies, characteristics of pedagogical communication, mechanisms of managing the learning process. Analyze organizational conflicts and ways to resolve them, psychological destruction and deformation of the teacher's personality.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

At the end of the course, the undergraduate must know the features of the modern system of higher professional education, the organization of pedagogical research, the characteristics of the subjects of the educational process, the didactic foundations of the organization of the learning process in higher education, pedagogical technologies, the patterns of pedagogical communication, the peculiarities of educational influences on undergraduates, as well as the problems of pedagogical activity.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Psychology of management

CODE - HUM205

CREDIT - 2(1/0/1)

PREREQUISITE - LNG102

THE PURPOSE AND OBJECTIVES OF THE COURSE

Teaching undergraduates the basics of higher school psychology, expanding their professional capabilities in terms of applying psychological knowledge in the field of teaching.

BRIEF DESCRIPTION OF THE COURSE

The psychological structure of the learning process, the psychology of cognitive activity, psychological methods and means of increasing the efficiency and quality of education in modern conditions, the psychology of the individual and the student body, the upbringing and formation of professional self-awareness, psychodiagnostics in higher education, the psychological characteristics of the pedagogical activity of a teacher of higher education, the student as a subject educational activities, psychological and pedagogical communication, psychology of pedagogical influence, the main psychological problems in pedagogical activity.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

At the end of the course, the undergraduate must master basic knowledge, skills and abilities about the socio-psychological nature of pedagogical activity, about the properties of mental and cognitive processes included in cognitive activity, about the content and specifics of psychological and pedagogical influence, about the individual characteristics of objects of influence of skills, be able to use the necessary psychological and methodological resources for the preparation and conduct of classes (lectures, seminars, SRSP and exams); be able to apply adequate psychodiagnostic methods for researching the personality of a master student and a student group; manage the learning process, on various aspects of communication in the field of professional activity, professional reflection, mastery of the main methods of psychological influence.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Means and methods of experimental research

CODE – **HYD226**

CREDIT – 2 (1/0/1)

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

THE PURPOSE AND OBJECTIVES OF THE COURSE

Mastering the knowledge and skills necessary for the metrological foundations of measurement; implementation of design solutions in the construction of engineering systems.

BRIEF DESCRIPTION OF THE COURSE

- general information about temperature measurements;
- general information about pressure measurement;
- general information about the humidity of air and materials;
- determination of the composition of gases;
- general information about measuring the amount and consumption of substances;
- classification of devices for measuring levels;
- measurement of the speed of air movement.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

Knowledge:

- measurement accuracy, measurement error;
- measuring instruments, metrological characteristics of measuring instruments;
- assessment of random errors of equal measurements;

Skills and abilities:

- determination of the random error of multiple measurements
- determination of the random error of single measurements;
- taking into account the random error of multiple and single measurements;
- determination of the random error of indirect measurements.

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Methods for calculating the energy efficiency of buildings and structures

CODE – HYD260

CREDIT – 2 (1/0/1)

PREREQUISITE – mathematics, physics, heat generating installations, heating and ventilation.

THE PURPOSE AND OBJECTIVES OF THE COURSE

To acquaint undergraduates with the problems in heat and gas supply and ventilation systems and methods for optimizing the parameters of heating, ventilation, hot water supply systems; heat supply, gas supply and heat generating plants; with modern control methods for the efficient use of heat and reducing heat losses in heat and gas supply systems.

BRIEF DESCRIPTION OF THE COURSE

Gives an idea about energy resources and the principles of their saving, about energy saving methods 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, the master student must 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;
- methods of underground coal gasification;
- principles of using solar energy, geothermal energy and wind energy;

be able to:

- 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;
- calculate the systems for utilizing the heat of the air removed from the premises and select equipment for heat recovery installations;

Designed by:	Reviewed: meeting of the Academic Council of the Institute	Approved by: Educational and methodological council of KazNRTU	Page 1 of 50
--------------	--	--	--------------

Innovative technologies for natural and waste water treatment

CODE – HYD248

CREDIT – 2 (1/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills on the methods and technologies of purification and treatment of natural and waste waters and their application in practical work in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve the problems of purifying natural waters, neutralizing, re-using wastewater and releasing them into water bodies.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems of natural and waste water treatment in the Republic of Kazakhstan;
- methods and schemes of natural and waste water treatment;
- types and designs of main water supply and drainage facilities for natural and waste water treatment;
- the basics of calculating water supply and drainage facilities for the treatment of natural and waste waters.

Be able to:

- choose a technological scheme for water purification;
- to determine the main parameters of the processes of purification and treatment of natural and waste waters;
- choose methods of natural and waste water treatment.

Heat generators and autonomous heating of buildings

CODE – **HYD249**

CREDIT – 2 (1/0/1)

PREREQUISITE – building thermal physics, heat and mass transfer, heating, ventilation and air conditioning, hot water supply systems for buildings.

THE PURPOSE AND OBJECTIVES OF THE COURSE

To give theoretical knowledge and practical skills in monitoring the operation of engineering systems of buildings and on the types of heat generators; information support with modern methods of organizing heat consumption.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, undergraduates must have an idea of the current state of engineering systems of buildings; on the methods of calculating heat loads on heating, ventilation and hot water supply systems of buildings; with types, schemes and principles of heat generators.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, a master student must:

know - the theoretical foundations and methods for determining the design loads by various consumers; basics, schemes and methods of water distribution for heating, ventilation and hot water supply systems; calculation features depending on the type of heat supply system.

be able to - apply in practice theoretical knowledge and skills; use the methods for determining the design loads; carry out calculations for the choice of the diameter of pipelines by type of heat consumption, depending on the type of heat supply system and use modern computer programs when performing calculations.

Innovative design solutions for water supply and sewerage systems and structures
CODE – HYD250

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills of modern design, the use of innovative programs in the calculation and design of the treatment of water supply and sanitation systems and facilities and their application in practical work in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve the problems of using innovative technologies for purifying natural waters, neutralizing, reusing waste water and releasing them into water bodies.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems of natural and waste water treatment in the Republic of Kazakhstan;
- modern methods and schemes of natural and waste water treatment;
- types and designs of modern main facilities for the treatment of natural and waste waters;
- the basics of calculating water supply and drainage facilities for the treatment of natural and waste waters.

Be able to:

- choose an innovative technological scheme for water purification;
- to determine the main parameters of the processes of purification and treatment of natural and waste waters;
- choose innovative methods of natural and waste water treatment.

Effective eco-protective technologies in heat and gas supply and ventilation systems

CODE – **HYD251**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The goal of teaching the discipline "Effective environmental protection technologies in THG systems" is to study by undergraduates the effect of pollutant emissions on the environment, methods for calculating their amount, factors that determine the conditions for effective dispersion of harmful emissions in the atmosphere and modern methods of cleaning gases from dispersed particles and toxic gaseous ingredients, device and principle of operation of modern gas cleaning equipment, as well as economic aspects of the use of environmental protection measures, on the use of environmental protection technologies in heat-generating plants, in heating and ventilation systems.

BRIEF DESCRIPTION OF THE COURSE

As a result of studying the discipline, undergraduates should know: the nature of the impact of pollutants on the biosphere; structure of the atmosphere; basic concepts of the theory of turbulence and turbulent diffusion in a stratified atmosphere; method for determining the hydrodynamic and thermal rise of the jet of the ejection; principles of standardization of atmospheric air quality; classification of sources of emissions of pollutants; methodology for calculating gross emissions of pollutants and fields of their surface concentrations; methods for determining the values of maximum permissible emissions; methods for cleaning gases from dispersed particles and toxic gaseous ingredients; device and principle of operation of modern gas cleaning equipment; general principles.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the nature of the impact of pollutants on the biosphere;
- structure of the atmosphere;
- basic concepts of the theory of turbulence and turbulent diffusion in a stratified atmosphere;
- methodology for determining the hydrodynamic and thermal rise of the ejection jet;
- principles of standardization of atmospheric air quality;
- classification of sources of pollutant emissions;
- methodology for calculating gross emissions of pollutants and fields of their

surface concentrations;

- methods for determining the values of maximum permissible emissions;

- methods for cleaning gases from dispersed particles and toxic gaseous ingredients;

- device and principle of operation of modern gas cleaning equipment;

Modern technologies and equipment for water supply and sewerage systems

CODE – **HYD258**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills of modern design, the use of innovative programs and modern equipment in the calculation and design of the treatment of water supply and sewerage systems and facilities and their application in practical work in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve the problems of using modern technologies for purifying natural and waste waters, neutralizing, reusing waste waters and releasing them into water bodies, as well as using modern equipment.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- modern problems of natural and waste water treatment in the Republic of Kazakhstan;
- modern methods and equipment for natural and waste water treatment;
- types and designs of modern main facilities for the treatment of natural and waste waters;
- modern principles for calculating water supply and drainage facilities for the purification of natural and waste waters.

Be able to:

- use modern technologies for water purification;
- to determine the main parameters of the processes of purification and treatment of natural and waste waters;
- choose modern methods of natural and waste water treatment.

Methods for optimizing the parameters of heat and gas supply systems and heat generating plants

CODE – **HYD259**

CREDIT – 3 (2/0/1)

PREREQUISITE – building thermal physics and heat and mass transfer, heating and hot water supply systems for buildings, ventilation and air conditioning, heat generating units.

THE PURPOSE AND OBJECTIVES OF THE COURSE

To acquaint undergraduates with the problems in heat and gas supply systems and methods for optimizing the parameters of heating, ventilation, hot water supply systems; heat supply, gas supply and heat generating plants; with modern control methods for the efficient use of heat and reducing heat losses in heat and gas supply systems.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, undergraduates must have an idea of the current state of heat-consuming systems and gain knowledge on methods for solving problems in heat and gas supply systems, ventilation and heat-generating installations, as well as managing the processes of heat generation in heat sources.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, the master student must know:

- classification of energy resources;
- the structure of the energy balance;
- 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;
- methods of underground coal gasification;
- principles of using solar energy, geothermal energy and wind energy;

be able to:

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

Retechonology of wastewater treatment plants

CODE – **HYD255**

CREDIT – 2 (1/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills on the retechnologization of wastewater treatment facilities in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve the problems of retechnologizing wastewater treatment facilities.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems of retechnologization of wastewater treatment facilities in the Republic of Kazakhstan;
- types of retechnologization of wastewater treatment facilities;
- types and designs of the main wastewater treatment facilities;
- the main wastewater treatment facilities.

Be able to:

- select methods of wastewater treatment;
- to determine the main parameters of wastewater treatment facilities;

Adjustment of heating, ventilation and air conditioning systems

CODE – **HYD208**

CREDIT – 2 (1/0/1)

PREREQUISITE – heat supply, heating networks.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Acquisition of theoretical knowledge and practical skills by undergraduates in methods of calculating internal heating, ventilation and air conditioning systems, in the basics of design, device, installation and operation of hot water systems.

BRIEF DESCRIPTION OF THE COURSE

As a result of studying the discipline, masters should know the theoretical foundations and methods of calculating internal heating, ventilation and air conditioning systems, the basics of heat consumption; special programs for hydraulic calculation of pipelines, ensuring the reliability of the operation of special heating water systems, installation rules for the operation of special heating water systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, masters must

Know:

- the theoretical basis for calculating heating, ventilation and air conditioning systems.

Be able to:

- apply in practice the theoretical knowledge and skills gained to determine the calculated indicators for the adjustment of heating, ventilation and air conditioning systems.

Methods and tools for studying water purification processes

CODE – **HYD263**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to give an idea of modern methods and tools for researching water purification processes. Study of the theoretical foundations of research of the processes of operation of treatment facilities used in water purification. Carry out calculations and selection of research tools. Compilation of research methods for water purification.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems in the study of water purification processes and apply in practice different methods of water purification.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems for the protection of water resources in the Republic of Kazakhstan;
- types of water resources protection systems;
- types and designs of the main systems for the protection of water resources;
- the basics of the water resources protection system.

Be able to:

- choose systems for the protection of water resources;
- to define the main parameters of water resources protection systems;

Regulation of heat supply in heat supply systems

CODE – **HYD264**

CREDIT – 3 (2/0/1)

PREREQUISITE – heat and mass transfer, heating, ventilation and air conditioning, hot water supply systems for buildings.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Acquisition of theoretical knowledge and practical skills by undergraduates on the existing methods for calculating heat flows and methods for calculating the regulation of heat supply by types of heat loads; types, methods and ways of regulating heat supply.

BRIEF DESCRIPTION OF THE COURSE

Study of the theoretical foundations and methods for determining the calculated heat flows by various consumers; heat supply schemes in heat supply systems; bases for calculating heat supply by type of heat consumption; methods of distribution of network water from pipelines of heating networks; calculation features depending on the type of heat supply system and be able to use modern computer programs when performing calculations.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, a master student must:

know - the theoretical foundations and methods for determining the calculated heat fluxes by various consumers; heat supply schemes in heat supply systems; bases for calculating heat supply by type of heat consumption; methods of distribution of network water from pipelines of heating networks; calculation features depending on the type of heat supply system.

be able to - apply in practice theoretical knowledge and skills; use methods for determining the calculated heat fluxes; to carry out calculations for the regulation of heat supply by types of heat consumption, depending on the type of heat supply system and use modern computer programs when performing calculations.

Water protection systems

CODE – **HYD219**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills on systems for protecting water resources in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems in water resources protection systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems for the protection of water resources in the Republic of Kazakhstan;
- types of water resources protection systems;
- types and designs of the main systems for the protection of water resources;
- the basics of the water resources protection system.

Be able to:

- choose systems for the protection of water resources;
- to define the main parameters of water resources protection systems;

Saving heat and energy in HGV systems

CODE – **HYD225**

CREDIT – 3 (2/0/1)

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

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline "Saving heat and energy in HGV systems" is to study the classification of energy resources; methods and means of energy saving in HGV systems;

BRIEF DESCRIPTION OF THE COURSE

- 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 of utilizing the heat of air removed by ventilation systems;
- general principles of energy technology use of agricultural, urban and industrial waste;

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

Knowledge:

- methods of underground coal gasification;
- options for energy technological processing of low-grade fuels;
- principles of using solar energy, geothermal energy and wind energy;
- fundamentals of energy production at nuclear power plants and nuclear power plants;
- general principles and prospects for the use of MHD generators;
- economic aspects of the use of energy-saving technologies.

Skills and abilities:

- assess the economic feasibility of using energy-saving technologies;
- evaluate the efficiency of energy saving measures in heat generating installations;
- develop measures to save energy in heating systems;
- calculate the systems for the utilization of the heat of the air removed from the premises and select the equipment for heat recovery installations;
- develop geothermal heating systems and perform calculations for solar installations.

Modern computer calculations of heat and gas supply and ventilation systems

CODE – HYD253

CREDIT – 3 (2/0/1)

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

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a holistic understanding of new computer calculations in the study of heat and gas supply and ventilation systems among undergraduates.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems on computers of heat and gas supply and ventilation systems, taking into account the modern achievements of various fields. It serves as the basis for the preparation of a master's student to master the elements of scientific research methods, contributes to the development of creative thinking; organization of optimal mental activity of the future undergraduate in the field of heat and gas supply and ventilation.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, a master student must:

Know:

- basic concepts and methods of computer analysis and algorithms for their implementation, the structure of calculated heat flows by various consumers;
- use of modern computer calculations of heat supply in heat supply systems;
- perspectives and tasks of computer calculations for heat and gas supply and ventilation systems.

Be able to:

- carry out computer calculations for the main tasks of the theory of probability and work with information systems;
- make a computer calculation of heat and gas supply and ventilation systems for communal and industrial enterprises;
- on a computer, calculate the limits in heat and gas supply and ventilation systems, calculate the water balance of a settlement, industrial, agricultural enterprise;
- calculate the payment for heat and gas supply and ventilation systems, calculate the payment for regulating heat supply by types of heat consumption, draw up a plan for environmental protection measures of the enterprise, evaluate the methodology for determining the calculated heat fluxes and their possibility of using for various needs.

Modern computer calculations of water supply and sewerage systems

CODE – **HYD252**

CREDIT – 3 (2/0/1)

PREREQUISITE – sanitary engineering of buildings, water transportation, equipment and technology of water purification.

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 water supply and sewerage systems among undergraduates.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems on computers of water supply and sewerage systems, taking into account the modern achievements of various fields. It serves as the basis for the preparation of a master's student to master the elements of scientific research methods, contributes to the development of creative thinking; organization of optimal mental activity of the future undergraduate in the field of water supply and sewerage.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- basic concepts and methods of computer analysis and algorithms for their implementation, the structure of the water management complex for the use of water resources and water use in the Republic of Kazakhstan;
- use of modern computer calculations for water supply and sewerage systems, water balances;
- prospects and tasks of computer calculations for the integrated use of water resources and water use.

Be able to:

- carry out a computer calculation of the main tasks of the theory of probability and work with information systems;
- make a computer calculation of water consumption and wastewater disposal of municipal and industrial enterprises;
- on a computer, calculate the limits of the enterprise for water consumption and wastewater disposal, calculate the water balance of a settlement, industrial, agricultural enterprise;
- draw up a report on water use, calculate the economic damage from the discharge of polluted and purified wastewater into a water body;
- calculate the payment for the discharge of normatively treated wastewater into the reservoir, calculate the payment for the intake of surface and groundwater within and above the limit, draw up a plan for environmental protection measures

of the enterprise, assess the quality of surface and groundwater in the region and their possibility of using it for various needs, draw up a report about the environmental activities of the enterprise.

Modern methods of modernization of water treatment facilities

CODE – **HYD254**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a complex of knowledge and skills on modern methods of modernizing water treatment facilities in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems with modern methods of modernizing water treatment facilities.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems with modern methods of modernization of water treatment facilities in the Republic of Kazakhstan;
- types of modern methods of modernization of water treatment facilities;
- types and designs of the main modern methods of modernization of water treatment facilities;
- the basics of modernization of water treatment facilities.

Be able to:

- select methods of modernization of water treatment facilities;
- to determine the main parameters of the modernization of water treatment facilities;

Adjustment and reconstruction of heat supply systems

CODE – **HYD207**

CREDIT – 3 (2/0/1)

PREREQUISITE – heat supply, heating networks.

THE PURPOSE AND OBJECTIVES OF THE COURSE

Acquisition of theoretical knowledge and practical skills by undergraduates in methods of calculating heat consumption in existing heat supply systems; methods of calculating temperature graphs by type of heat consumption, depending on the type of heat supply system.

BRIEF DESCRIPTION OF THE COURSE

As a result of studying the discipline, undergraduates must know the theoretical foundations and methods for calculating heat flows by various consumers; heat supply schemes in heat supply systems; methods of distribution of network water from pipelines of heating networks and calculation features depending on the type of heat supply system; the basic principles of adjustment and reconstruction of heat supply systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must:

Know - the theoretical foundations for calculating heat flows of a heat supply system, calculating heat supply by types of heat loads and ways to regulate heat loads.

To be able to - apply in practice the theoretical knowledge and skills in determining the calculated indicators for the design of a centralized heating system; apply modern computer programs when performing calculations for reconstruction; carry out adjustment of the main elements of the heat supply system.

Organization, planning and management of water supply and sewerage enterprises
CODE – **HYD261**

CREDIT – 3 (2/0/1)

PREREQUISITE – hydraulics, integrated water resources management, water resources management.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is the organization, planning and management of water supply and sewerage enterprises, as well as the application of skills in the field of water supply and sewerage systems.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve the problems of organizing, planning and managing the enterprise of water supply and sewerage systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems of organization, planning and management of modern water supply and sewerage systems in the Republic of Kazakhstan;
- methods of organizing water supply and sewerage systems;
- planning and management of water supply and drainage facilities for the treatment of natural and waste water.

Be able to:

- to solve the problems of planning and management of modern water supply and sewerage systems;
- to determine the main parameters of the operation of modern water supply and sewerage systems;
- choose a method of organizing water supply and sewerage systems.

Normative legal regulation of the design of heat and gas supply and ventilation systems

CODE – **HYD262**

CREDIT – 3 (2/0/1)

PREREQUISITE – fluid dynamics, heat generating installations, construction thermal physics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is the acquisition of theoretical knowledge and practical skills by undergraduates in the legal regulation of the design of heat and gas supply and ventilation systems.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, undergraduates must know special programs for the hydraulic calculation of pipelines of HGV systems; types, characteristics and selection of modern equipment for special HGV systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- to apply in practice the theoretical knowledge gained in the field of legal regulation of the design of heat and gas supply and ventilation systems;

Be able to:

- to apply in practice the theoretical knowledge gained in the field of legal regulation of the design of heat and gas supply and ventilation systems
- solve the problems of planning and control of modern heat and gas supply and ventilation systems;
- to determine the main parameters of operation of modern heat and gas supply and ventilation systems;
- choose a method of organizing heat and gas supply and ventilation systems.

Actual problems of operation of modern water supply and sewerage systems

CODE – **HYD256**

CREDIT – 3 (2/0/1)

PREREQUISITE – physics, chemistry, water chemistry and microbiology, hydraulics.

THE PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline is to form a set of knowledge and skills on the problems of operating modern water supply and sewerage systems in the field of water management.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, future specialists are preparing to solve problems related to the operation of modern water supply and sewerage systems.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, undergraduates must

Know:

- the main problems of the operation of modern water supply and sewerage systems in the Republic of Kazakhstan;
- methods and schemes of natural and waste water treatment;
- types and designs of the main water supply and drainage facilities for the treatment of natural and waste waters;
- the basics of calculating water supply and drainage facilities for the treatment of natural and waste waters.

Be able to:

- select the problems of operation of modern water supply and sewerage systems;
- to determine the main parameters of the operation of modern water supply and sewerage systems;
- choose methods of natural and waste water treatment.

Actual problems of operation of modern heat and gas supply and ventilation systems

CODE – **HYD257**

CREDIT – 3 (2/0/1)

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

THE PURPOSE AND OBJECTIVES OF THE COURSE

To acquaint undergraduates with the results of monitoring on the problems of existing heating, ventilation, hot water supply systems in buildings; with modern methods of organizing heat consumption in HGV systems; with measures for the operation of HGV systems.

BRIEF DESCRIPTION OF THE COURSE

In the process of studying the discipline, undergraduates should receive information about the current state of housing and communal services; on the management of the communal sector of cities and towns; on methods of reducing heat losses and monitoring the efficient use of heat in HGV systems; on the rules for the operation of internal engineering systems and external networks.

KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE

As a result of studying the discipline, masters must:

Know - the theoretical foundations for calculating the heat flows of the heat supply system; modern methods of organizing heat consumption in HGV systems; methods of management of the communal sector of cities and settlements; measures for the operation of HGV systems.

To be able to - apply in practice the theoretical knowledge and skills in determining the calculated indicators for the design of a centralized heating system; apply modern computer programs when performing calculations for reconstruction; adjust the main elements of heat supply systems.

Master's thesis defense

CODE – ECA203

CREDIT –3

THE PURPOSE OF THE MASTER'S THESIS IS:

demonstration of the level of scientific / research qualifications of a master's student, the ability to independently conduct scientific research, testing the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.

BRIEF DESCRIPTION OF THE COURSE

Master's thesis is a final qualifying scientific work, which is a generalization of the results of independent research by a master's student of one of the urgent problems of a particular specialty of the corresponding branch of science, which has an internal unity and reflects the course and results of the development of the chosen topic.

The master's thesis is the result of the research / experimental research work of the master student, carried out during the entire period of the master's student's training.

The defense of a master's thesis is the final stage of the master's preparation. A master's thesis must meet the following requirements:

- research should be carried out in the work or urgent problems in the field of engineering systems of buildings and structures should be solved;
- work should be based on the definition of important scientific problems and their solution;
- decisions must be scientifically grounded and reliable, have internal unity;
- the thesis should be written individually;

Content

1 Scope and content of the program	5
2 Requirements for applicants	7
3 Requirements for completing studies and obtaining a diploma	8
4 Working curriculum of the educational program	10
5 Modular educational program	13
6 Descriptors of the level and amount of knowledge, abilities, skills and competencies	15
7 Completion competencies	15
8 Annex to the certificate according to the standard ECTS	19