

**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**

**7M07312 - "Engineering systems and networks"**  
**(profile direction (1y.))**

**7M07312 – "Engineering systems and networks"**  
**Master of engineering and technology**

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. 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:

7M07312-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, 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.

### **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;
- experimental research.

Specific activities are determined by the content of the educational and professional program developed by the university. Организационно-управленческая деятельность:

- 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.

## 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 profile master's program there are 60 academic credits with a study period of 1 year.

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 the profile direction implements educational programs of postgraduate education for the training of management personnel with in-depth professional 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) experimental research work, including the implementation of a master's project - for a specialized master's program;
- 4) final certification.

#### **OP content**

When implementing the educational program of the specialty of postgraduate education 7M07312 "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 7M07312 "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.

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:

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- for scientific and pedagogical training - at least 37 credits, of which at least 16 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.

A summary table reflecting the volume of disbursed loans in the context of modules of the educational program of the specialty 7M07312 "Engineering systems and networks". Objectives of the educational program:

The main objectives of the Master's degree program in the specialty - 7M07312 "Engineering systems and networks" are:

- training of specialized personnel for work, regardless of the form of ownership and subordination: in the bureau; in companies, firms and organizations (enterprises) of construction and other infrastructures of the economy;

## 2 Requirements for applicants

Previous level of education of entrants – higher professional education (bachelor). 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 admission of citizens to the master's degree is established in accordance with the "Standard rules for admission to educational institutions that implement educational programs of postgraduate education."

The formation of the contingent of undergraduates is carried out through the placement of the state educational order for the training of scientific and pedagogical personnel, as well as payment for training at the expense of citizens' own funds and other sources. Citizens of the Republic of Kazakhstan shall be provided with the right to receive free postgraduate education on a competitive basis in accordance with the state educational order, if they receive this level for the first time.

At the "entrance" the master student must have all the prerequisites necessary for the development of the appropriate educational program of the magistracy. The list of necessary prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites undergraduates are allowed to master them on a fee basis.



### 3 Requirements for completion of studies and diploma

#### Degree / qualifications awarded

The graduate of this educational program is awarded the academic degree "master of engineering and technology" in the direction.

A graduate who has mastered the master's program, must have the following General professional competencies:

- the ability to independently acquire, comprehend, structure and use in professional activity new knowledge and skills, to develop their innovative abilities;
- the ability to independently formulate research goals, establish the sequence of professional tasks;
- the ability to apply in practice knowledge of fundamental and applied sections of disciplines that determine the direction (profile) of the master's program;
- the ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems;
- ability to critically analyze, present, protect, discuss and disseminate the results of their professional activities;
- possession of skills of drawing up and registration of scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead the team in the field of their professional activities, tolerant of social, ethnic, religious and cultural differences;
- readiness for communication in oral and written forms in a foreign language to solve the problems of professional activity.

A graduate who has mastered the master's program 7M07312 – Engineering systems and networks, must have professional competencies corresponding to the types of professional activities to which the master's program is focused:

research and production activities:

- the ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;
- ability to professional operation of modern field and laboratory equipment and devices in the field of master's degree program;
- the ability to use modern methods of processing and interpretation of complex information to solve production problems;

project activity:

- the ability to independently prepare and submit projects of research and production works;
- readiness to design complex research and production works in solving professional problems;

organizational and management activities:

- readiness to use practical skills of organization and management of research and production works in solving professional problems;



– readiness for practical use of normative documents in the planning and organization of scientific and production works.

When developing a master's programme, all General cultural and General professional competences, as well as professional competences related to the types of professional activity for which the master's programme is focused, are included in the set of required results of the master's programme.

## 4 Working curriculum of the educational program

### 4.1. Duration of training 1 year

#### WORKING CURRICULUM

Degree: Master of engineering and technology

Duration of training: 1 year

year of study	Code	Name of course	Component	Academic credits	lec/ lab/ prac/MSIW	Prerequisites	Code	Name of course	Component	Academic credits	lec/ lab/ prac/MSIW	Prerequisites			
1	1 semester						2 semester								
	LNG209	Foreign language (professional)	BD IC	4	0/0/3/3		AAP207	Master's student experimental research work, including internship and master's project implementation	MSERW	13					
	MNG274	Management	BD IC	6	2/0/1/3		AAP248	Work placement	PS	7					
	HUM204	Management Psychology	BD OC	4	1/0/1/2		ECA206	Registration and defense of the master's project (RaDMP)	FA	12					
	2203	Elective	BD OC	6											
	2303	Elective	PS OC	6											
	HYD265	Information technology engineering systems	PS OC	6											
	HYD239	Rational use of fuel energy resources	PS OC												
	AAP207	Master's experimental-research work	MSSR	6											
		In total			38			In total			32				
							In all			70					

**THE CATALOG OF ELECTIVE DISCIPLINES**  
**7M07312 - «Engineering systems and networks»**

Degree: Master of engineering and technology

Duration of training: 1 year

BS Components of choice - 2 credits					
	code	Name of disciplines	credits	L	semester
2203	HYD231	Energy efficient heat generators	6	2/0/1/3	1
	HYD230	Water-saving technologies for water consumption and wastewater disposal of industrial enterprises			
2303	HYD242	Modern technologies for the design of heat supply systems for industrial enterprises	6	2/0/1/3	1
	HYD241	Modern technologies for the design of water supply and sewerage systems			
		<b>Total</b>	<b>12</b>		

## 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) (16 credits)										
University component (16 credits)										
BD 1.1.1	LNG202	Foreign language (professional)	1	6	0	0	3	3	Exam	EL
BD 1.2.1	MNG274	Management	1	6	2	0	1	3	Exam	SD
BD 1.3.1	HUM204	Management Psychology	1	4	1	0	1	2	Exam	S&EPMC
Component of choice (CC) (10 credits)										
Information technology module										
PS 1.4.1	HYD265	Information technology engineering systems	1	4	2	0	1	3	Exam	ESN
PS 1.4.2	HYD239	Rational use of fuel energy resources	1	6	2	0	1	3	Exam	ESN
Major disciplines (MD) (19 credits)										
University component (UC)										
MD	AAP248	Internship	2	7					Report	ESN
Component of choice (CC)										
Professional Research Module										
PS 1.1.1	HYD231	Heat generators with increased energy efficiency	2	6	2	0	1	3	Exam	ESN
PS 1.1.2	HYD230	Water-saving technologies for water consumption and wastewater disposal of industrial enterprises								
PS 1.2.1	HYD242	Modern technologies for designing heat supply systems for industrial enterprises	2	6	2	0	1	3	Exam	ESN
PS 1.2.2		HYD241								
Experimental Research Module (13 credits)										
MSE RW	AAP207	Master's student experimental research work, including internship and master's project implementation	2	13					Report	ESN
Final certification module (12 credits)										
FA	ECA206	Registration and defense of the master's project (RaDMP)	2	12					Project protection	
Total credits				70						

## 6 Descriptors of level and scope of knowledge, skills and competences

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

The results of training are formulated at the level of the entire educational program of the magistracy, and at the level of individual modules or discipline.

Descriptors reflect the learning outcomes characterizing the learner's abilities:

1) demonstrate developing knowledge and understanding in the field of architecture, urban planning, construction, engineering systems and networks, based on advanced knowledge, in the development and (or) application of ideas in the context of design and research activities;

2) apply professionally their knowledge, understanding and abilities to solve problems in a new environment, in a broader interdisciplinary context;

3) collect and interpret information to form judgments based on social, ethical and scientific considerations;

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

5) training skills necessary for self-continuation of further training in the field of architecture, urban planning, construction, engineering systems and networks.

## 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;

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:**

**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.

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.

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 ECTS Diploma Supplement

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.



**Foreign language (professional)**

CODE - LNG205

CREDIT - 3 (0/0/3)

PREREQUISIT - LNG201

**PURPOSE AND OBJECTIVES OF THE COURSE**

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

**SHORT 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, ABILITY, SKILLS TO COMPLETE THE COURSE**

As a result of mastering the discipline, the master's student expands the professional lexical vocabulary, possess 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.

**Project management**

CODE MNG230

CREDIT 3 (2/0/1)

PRE-REQUISIT

**PURPOSE AND OBJECTIVES OF THE COURSE**

Teaching master students the basics of project management, expanding their professional capabilities in terms of applying management knowledge in the field of professional activity.

**SHORT DESCRIPTION OF THE COURSE**

The discipline is aimed at preparing graduates for:

- the use of quantitative and qualitative methods to manage business processes and assess their effectiveness;
- design and management of any socio-economic system, part of the system, or process that satisfies the internal and external needs of the enterprise, organization;
- enterprise management; an organization or institution, including institutions of higher professional education and scientific institutions, as well as their departments, support of business processes in various areas of management, the use of modern tools for diagnosing activities and developing a strategy for the development of an enterprise and organization;
- preparing graduates for work in the constantly changing conditions of the internal and external environment of the enterprise, country and world.

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

At the end of the course, the master student must:

Know:

- the main functions of project management
- the use of modern methods of assessing the effectiveness of management programs, tasks, activities;
- - identification, formulation and solution of production tasks, including material, human and economic parameters;



**Psychology of management**

CODE - HUM205

CREDIT - 2 (1/0/1)

PREREQUISIT - LNG102

**PURPOSE AND OBJECTIVES OF THE COURSE**

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

**SHORT 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, ABILITY, SKILLS TO COMPLETE 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 of researching the personality of a master's student and student group; manage the learning process, in various aspects of communication in the field of professional activity, professional reflection, mastery of the main methods of psychological influence.

**Rational use of fuel and energy resources**

CODE: HYD239

CREDIT - 3 (2/0/1)

PREREKVISIT - physics, heat and mass transfer, building thermal physics.

**PURPOSE AND OBJECTIVES OF THE COURSE**

Study of the issues of rational use of fuel and energy resources in construction.

**SHORT DESCRIPTION OF THE COURSE**

Fuel and energy resources - the totality of all natural and converted types of fuel and energy used in the republic. Economists refer to FER as "natural fuel resources, natural energy resources, fuel processing products, combustible (fuel) by-product energy resources, electricity, compressed air and blast-furnace blast, thermal energy (steam and hot water)"

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

After mastering this discipline, the master student must:

**Know:**

- on reducing the energy intensity of products;
- on increasing the fuel efficiency;
- on increasing the share of local types of fuel and production waste, non-traditional and renewable sources in the fuel balance of the republic.

Be able to:

- implementation of the pre-production process in accordance with the optimal modes of commissioning of fixed assets;
- using the most cost-effective production technologies;
- development, mastering and implementation of new equipment and technologies in which energy resources are used more efficiently;
- improvement of the social sphere for the personnel of the enterprise and the social climate of the population living in the territory assigned to the respective enterprise

**Information technology engineering systems**

CODE: HYD

CREDIT - 3 (2/0/1)

PREKVISIT - physics, informatics, heat and mass transfer, heat generating installations, heating, ventilation, hot water supply systems, heat supply

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the discipline "Information technology of engineering systems" is to study control systems of engineering systems, to compare information systems.

**SHORT DESCRIPTION OF THE COURSE**

An overview of information systems of various classes used for the design and information support of engineering networks is carried out. Such product classes as geographic information systems, computer-aided design systems, and specialized systems are considered. Criteria for the practical suitability of systems are put forward and their joint assessment is carried out.

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

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

**Know:**

- information about information technologies of engineering systems;
- unique possibilities of IT technologies in use within the framework of innovative and traditional methods of teaching engineering systems;
- the use of information programs in the design of engineering systems of buildings and structures.

### **Energy efficient heat generators**

CODE: HYD231

CREDIT - 2 (1/0/1)

PREKVISIT - heat and mass transfer, heat generating installations, heating, ventilation, hot water supply systems, heat supply systems.

### **PURPOSE AND OBJECTIVES OF THE COURSE**

To acquaint undergraduates with the types and principles of operation of heat generators, as well as heating, ventilation and hot water supply systems for buildings, methods of calculating the heat loads of these systems; modern methods of organizing heat consumption.

### **SHORT DESCRIPTION OF THE COURSE**

In the process of studying the discipline, undergraduates must have an idea of the current state of heating, ventilation and hot water supply systems.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

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

#### **Know:**

- general information about heating, ventilation and hot water supply systems of buildings;
- methods for calculating the thermal loads of these systems;
- modern methods of organizing heat consumption;
- technological bases of heat consumption;
- types and characteristics of special HSGSaV systems;

#### **Be able to:**

- to apply in practice the obtained theoretical knowledge and skills to determine the calculated thermal loads of special heating systems;
- to apply modern methods and special programs for hydraulic calculation of pipelines of special heating water systems.

**Water-saving technologies for water consumption and wastewater disposal of industrial enterprises**

CODE: HYD230

CREDIT - 2 (1/0/1)

PREREKVISIT - mathematics, physics, chemistry, hydraulics and water transportation, technology of natural and waste water purification.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the discipline is the acquisition of theoretical knowledge and practical skills by undergraduates on the basics of water resources and the principles of their conservation, on methods of water saving in water use systems, on the principles of saving water resources at enterprises and in housing and communal services.

**SHORT DESCRIPTION OF THE COURSE**

The discipline gives an idea about water resources, the principles of saving water resources at enterprises and in housing and communal services, about water saving methods in water use systems, about the use of recycled and recycled water supply in all sectors of the economy.

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

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

**Know:**

- classification of water resources;
- the structure of the water balance;
- general principles of economy;
- a list of measures to save water resources in industry and housing and communal services;
- methods and means of water saving in housing and communal services systems;
- economic aspects of the use of water-saving technologies.

**Be able to:**

- to assess the economic feasibility of using water-saving technologies;
- evaluate the effectiveness of water-saving measures in the sectors of the economy and housing and communal services
- to develop measures to save water in water supply systems.

## **Modern technologies for the design of heat supply systems for industrial enterprises**

CODE: HYD242

CREDIT - 3 (2/0/1)

PREREQUISIT - mathematics, physics, chemistry, engineering mechanics, engineering systems of buildings and structures.

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The general task is to train specialists-masters for work in the field of construction, specialization "Engineering systems and networks".

### **SHORT DESCRIPTION OF THE COURSE**

Characteristics and features of heat supply for industrial enterprises. Heat consumers and their characteristics. Types of heat sources and characteristics of heat carriers. Regulation of heat release. Methods for hydraulic calculations of heating networks. Hydraulic modes and principles of development of piezometric graphs. Features of laying heating networks on the territories of industrial enterprises. Constructive elements and wiring diagram of heating networks. Fundamentals of reliability in the design, installation and operation of heat supply systems for industrial enterprises.

### **KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

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

**know** - the features of the heat supply of industrial enterprises; basics of designing modern heat supply systems; methods for determining thermal loads; methods of hydraulic calculations of heating networks and the development of piezometric graphs; features of laying heating networks; structural elements and principles of developing a wiring diagram; operation of heat supply systems of industrial enterprises.

**be able to** - apply in practice the theoretical knowledge and skills gained in the design of modern heat supply systems for industrial enterprises; perform a hydraulic calculation of pipelines of the heat supply system; develop piezometric graphs of heating networks; apply modern structural elements of heating networks; use modern technologies in the installation and operation of heat supply systems.



**Modern technologies for the design of water supply and sewerage systems**

CODE: HYD241

CREDIT - 3 (2/0/1)

PREREKVISIT - water supply, sewerage, rational use of water, closed water supply systems and operation of water supply systems.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the discipline is to give an idea of modern technologies for the design of water supply and sewerage systems.

**SHORT DESCRIPTION OF THE COURSE**

"Modern technologies for the design of water supply and sewerage systems" is the acquisition of theoretical knowledge and practical skills by undergraduates in the basics of design, reconstruction and intensification of engineering systems of water supply and sewerage.

**KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE**

As a result of studying the discipline, the undergraduate must know:

- to improve the efficiency and quality of the sewerage system based on the reconstruction and improvement of engineering structures;
- to study the techniques and methods of performing the elements of intensification and reconstruction of methods and technologies of water supply and sewerage systems;
- to reduce the consumption of material resources, as well as to promote rational use and protection from pollution by wastewater.

**Master's project defense**

CODE – ECA2013

CREDIT –7

The purpose of the master's thesis is:

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

**SHORT DESCRIPTION**

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;

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