

**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**

**7M07311 "Engineering systems and networks"  
(profile direction (1,5 y.))**

**7M07311 – "Engineering systems and networks"  
Master of engineering and technology**

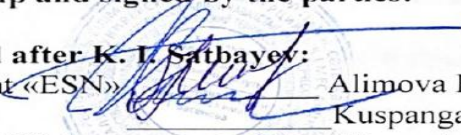


1st edition  
in accordance with the SCES of higher education 2018

**Almaty 2020**

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 1 of 41
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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:

7M07311-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.

Organizational and managerial activities:

- 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.

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.

## 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 90 academic credits with a study period of 1.5 years.

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 7M07311 "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 7M07311 "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 main criterion for the completeness of the educational process for the preparation of masters is the development of master students:

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 5 of 41
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- for scientific and pedagogical training - at least 56 credits, of which at least 31 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.

### **Objectives of the educational program:**

The main objectives of the Master's degree program in the specialty - 7M07311 "Engineering systems and networks" are:

- training of specialized personnel for work, regardless of the form of ownership and subordination: in research and design institutions; in bureaus, 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 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 diplom

**Awarded degree / qualifications:** The graduate of this educational program is awarded the academic degree "Master of Engineering and Technology" 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:

- production activities:
  - the ability to independently carry out production, field and 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;

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.



## 4 Working curriculum of the educational program

### 4.1. Duration of training 1,5 years

### WORKING CURRICULUM

Degree: Master of engineering and technology

Duration of training: 1,5 years

year of study	Code	Name of course	Component	Academic credits	lecture/ lab/ prac/MSIW	Prerequisites	Code	Name of course	Component	lecture/ lab/ prac/MSIW	Prerequisites																																	
<b>1</b>	<b>1 semester</b>						<b>2 semester</b>																																					
	LNG202	Foreign language (professional)	BD IC	6	0/0/3/3		2204	Elective	BD OC	4																																		
	MNG274	Management	BD IC	6	2/0/1/3		2304	Elective	PS OC	6																																		
	HUM204	Management Psychology	BD OC	4	1/0/1/2		2305	Elective	PS OC	6																																		
	HYD239	Rational use of fuel energy resources	BD OC	6			2306	Elective	PS OC	6																																		
	2203	Elective	PS OC	6			2307	Elective	PS OC	6																																		
	2303	Elective	PS OC	6			AAP221	Master's student experimental research work, including internship and master's project implementation	MSERW	4																																		
	<b>In total</b>			<b>34</b>			<b>In total</b>			<b>32</b>																																		
<b>2</b>	<b>3 semester</b>																																											
	AAP220	Master's student experimental research work, including internship and master's project implementation	MSERW	14			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">Number of credits for the whole period of study</th> </tr> <tr> <th style="text-align: center;">Cycles of disciplines</th> <th style="text-align: center;">Credits</th> </tr> <tr> <td>The cycle of general education</td> <td style="text-align: center;">0</td> </tr> <tr> <td>Decision of the Academic Board of Satbaev University. Protocol No. ___ of "___" ___ 20__.</td> <td style="text-align: center;">A cycle of basic disciplines ( BD IC, BD OC)</td> <td style="text-align: center;">26</td> </tr> <tr> <td>Decision of the Academic Board of the Institute _____ Protocol No. ___ of "___" ___ 20__.</td> <td style="text-align: center;">A cycle of principal subjects (PS IC, PS OC)</td> <td style="text-align: center;">45</td> </tr> <tr> <td><b>Vice-Rector for Research and Academic Affairs</b></td> <td style="text-align: center;"><b>D.K. Naurzybayeva</b></td> <td style="text-align: center;"><b>All on the theoretical classes:</b></td> <td style="text-align: center;"><b>71</b></td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">MSERW</td> <td style="text-align: center;">18</td> </tr> <tr> <td><b>Chair of the APC</b></td> <td style="text-align: center;"><b>K.B. Tulegenova</b></td> <td style="text-align: center;">Registration and defense of the master's thesis</td> <td style="text-align: center;">12</td> </tr> <tr> <td><b>Director of the Institute</b></td> <td style="text-align: center;"><b>B.U. Kuspangaliev</b></td> <td style="text-align: center;"><b>In total</b></td> <td style="text-align: center;"><b>101</b></td> </tr> <tr> <td><b>Head of the Department</b></td> <td style="text-align: center;"><b>K.K. Alimova</b></td> <td></td> <td></td> </tr> </table>						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 "___" ___ 20__.	A cycle of basic disciplines ( BD IC, BD OC)	26	Decision of the Academic Board of the Institute _____ Protocol No. ___ of "___" ___ 20__.	A cycle of principal subjects (PS IC, PS OC)	45	<b>Vice-Rector for Research and Academic Affairs</b>	<b>D.K. Naurzybayeva</b>	<b>All on the theoretical classes:</b>	<b>71</b>			MSERW	18	<b>Chair of the APC</b>	<b>K.B. Tulegenova</b>	Registration and defense of the master's thesis	12	<b>Director of the Institute</b>	<b>B.U. Kuspangaliev</b>	<b>In total</b>	<b>101</b>	<b>Head of the Department</b>	<b>K.K. Alimova</b>		
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AAP246	Work placement	PS	9																																									
ECA206	Registration and defense of the master's thesis	FA	12																																									
	<b>In total</b>		<b>35</b>																																									
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**THE CATALOG OF ELECTIVE DISCIPLINES**  
**of the Educational program «Engineering systems and networks»**  
**on the basis of the following majors of invalid Classifier of specialty: 6M075200«Engineering systems and networks»**

**Degree: Master of engineering and technology**

**Duration of training: 1.5 year**

Code of elective	Code	Name of discipline	Credits	lec/lab/pr	Semester
2203	HYD231	Heat generators with increased energy efficiency	6	2/0/1/3	1
	HYD230	Water-saving technologies for water consumption and wastewater disposal of industrial enterprises	6	2/0/1/3	
2303	HYD242	Modern technologies for designing heat supply systems for industrial enterprises	4	1/0/1/2	2
	HYD241	Modern technologies for the design of water supply and drainage systems	4	1/0/1/2	
Total			<b>20</b>		
Code of elective	Code	Name of discipline	Credits	lec/lab/pr	Semester
2204	HYD243	Special issues of heat supply in construction	6	2/0/1/3	2
	HYD209	Standardization of discharge of industrial wastewater	6	2/0/1/3	
2304	HYD244	Theoretical foundations of microclimate of premises	6	2/0/1/3	2
	HYD232	Innovative technologies in water supply and drainage systems of industrial enterprises	6	2/0/1/3	
2305	HYD238	Rational use of heat and gas in construction	6	2/0/1/3	2
	HYD240	Modern technologies in the reconstruction of water supply and drainage systems and structures	6	2/0/1/3	
2306	HYD234	Methods and means of research of thermal engineering processes	6	2/0/1/3	2
	HYD263	Methods and means of studying water purification processes	6	2/0/1/3	
2307	HYD207	Adjustment and reconstruction of heat supply systems	6	2/0/1/3	2
	HYD216	Start-up and adjustment of water supply and sewerage facilities	6	2/0/1/3	
Total			<b>60</b>		

## 5 Modular educational program

The cycle	Code	Name of disciplines	Semester	Academ credit.	lecture	lab.	practice	IWS	Type of control	Chair
<b>Profile training module</b>										
<b>Basic disciplines (BD) (16 credits)</b>										
<b>University component (UC) (16 credits)</b>										
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	SEPMC
<b>Component of choice (CC) (10 credits)</b>										
<b>Module of special questions in engineering systems</b>										
BD 1.4.1	HYD231	Heat generators with increased energy efficiency	1	6	2	0	1	3	Exam	ESN
BD 1.4.2	HYD230	Water-saving technologies for water consumption and wastewater disposal of industrial enterprises								
BD 1.5.1	HYD242	Modern technologies for designing heat supply systems for industrial enterprises	2	4	1	0	1	2	Exam	ESN
BD 1.5.2	HYD241	Modern technologies for the design of water supply and drainage systems								
<b>Major disciplines (MD) (19 credits)</b>										
<b>University component (UC)</b>										
PS	AAP248	Internship	2	7					Report	ESN
<b>Module of theory and practice of engineering systems</b>										
PS 1.1.1	HYD239	Rational use of fuel energy resources	1	6	0	0	3	3	Exam	ESN
<b>Choice component (CC)</b>										
<b>Professional research Module</b>										
PS 1.3.1	HYD238	Rational use of heat and gas in construction	2	6	2	0	1	3	Exam	ESN
PS 1.3.2	HYD240	Modern technologies in the reconstruction of water supply and drainage systems and structures								
PS 1.4.1	HYD234	Methods and means of research of thermal engineering processes	2	6	2	0	1	3	Exam	ESN
PS 1.4.2	HYD263	Methods and means of studying water purification processes								
Developed:			Discussed: meeting of the INSTITUTE			Approved: E&MB of Satbayev University			Page 11 of 41	

PS 1.5.1	HYD207	Adjustment and reconstruction of heat supply systems	2	6	2	0	1	3	Exam	ESN
PS 1.5.2	HYD216	Start-up and adjustment of water supply and sewerage facilities								
PS 1.1	HYD243	Special issues of heat supply in construction	1	6	2	0	1	3	Exam	ESN
PS 1.1.2	HYD209	Standardization of discharge of industrial wastewater								
PS 1.2	HYD244	Theoretical foundations of microclimate of premises	2	6	2	0	1	3	Exam	ESN
PS 1.2.2	HYD232	Innovative technologies in water supply and drainage systems of industrial enterprises								
PS	AAP248	Work placement	2	7					Report	ESN
<b>Experimental research module (18 credits)</b>										
MSE RW	AAP220	Master's student experimental research work, including internship and master's project implementation	2	4					Report	ESN
MSE RW	AAP221	Master's student experimental research work, including internship and master's project implementation	3	14					Report	ESN
<b>Final certification module (12 credits)</b>										
FA	ECA206	Registration and defense of the master's thesis	4	12					Project protection	
<b>In total</b>				<b>101</b>						

## 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;

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 – LNG201

CREDIT – 3 (0/0/3)

PREREQUISITE – Academic English, Business English, IELTS 5.0-5.5

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**THE PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is to develop students ' English language skills for their current academic studies and improve their performance in project management

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 18 of 41
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### **BRIEF DESCRIPTION OF THE COURSE**

The course aims to build vocabulary and grammar for effective communication in project management and to improve reading, writing, listening and speaking skills at the Intermediate level. It is expected that students will acquire a vocabulary of business English and learn grammar structures, which are often used in the context of management. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, and the 6th module is accompanied by a test at the end of the course. The course ends with the final exam. Students also need to practice on their own (MIS). MIS - independent work of undergraduates under the guidance of a teacher.

### **KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE**

Upon successful completion of the course, students are expected to be able to recognize the main idea and message, as well as specific details when listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English on topics related to management; write management texts (reports, letters, e-mails, minutes of meetings), following the generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, talk about different business situations, using the appropriate business vocabulary and grammatical structures - in pairs and group discussions, meetings and negotiations.

**Project management**

CODE – MNG230

CREDIT – 2(1/0/1)

PREREQUISITE – \_\_\_\_\_

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**THE PURPOSES AND OBJECTIVES OF THE COURSE**

Training of undergraduates in the basics of project management, the expansion of their professional capabilities in terms of the application of management knowledge in the field of professional activity.

**BRIEF DESCRIPTION OF THE COURSE**

The discipline is aimed at preparing graduates for:

- use of quantitative and qualitative methods to manage business processes and evaluate their effectiveness;
- design and management of any socio-economic system, part of the system, or process that meets the internal and external needs of the enterprise, organization;
- enterprise management; organization or institution, including institutions of higher professional education and research institutions, as well as their departments, support of business processes in different areas of management, the use of modern tools for the diagnosis of activities and development of the development strategy of the enterprise and organization;
- preparation of graduates to work in the ever-changing conditions of internal and external environment of the enterprise, the country and the world.

**KNOWLEDGE AND SKILLS UPON COMPLETION OF THE COURSE**

Know:

- 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 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.

**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: HYD269

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 - 3 (2/0/1)

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 THV 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 - 3 (2/0/1)

PREREQUISIT - 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.

**Special issues of heat supply in construction**

CODE: HYD243

CREDIT - 2 (1/0/1)

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**

The structure of the heat supply system of cities and towns. Characteristics of heat consumers and heat supply sources. Estimated capacity of the heat source to serve the needs of construction. Stationary and mobile heat sources. The required thermal power for drying the building. Devices and equipment for drying buildings under construction.

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

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

know - the structure of heat supply systems; theoretical foundations and methods for determining thermal loads; types and characteristics of heat sources; devices and equipment for drying in the construction of new buildings.

be able to - apply in practice the theoretical knowledge and skills acquired; use methods for determining the calculated indicators of heat supply; use modern technologies in the installation and operation of heat supply in construction.

**Regulation of industrial waste water discharge**

CODE: HYD209

CREDIT - 2 (1/0/1)

PREREKVISIT - physics, chemistry, water chemistry and microbiology, water supply, sewerage, rational use of water, operation of water supply systems.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline is to form a complex of knowledge of skills on modern methods of standardizing industrial wastewater discharge.

**SHORT DESCRIPTION OF THE COURSE**

"Standardization of industrial wastewater discharge" gives an idea of modern methods of forming standards for maximum permissible concentrations of wastewater discharged into natural sources. Establishment of norms for water consumption and disposal, water losses.

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

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

Know - a feasibility study for drawing up schemes for the integrated use and protection of water resources of basin rivers, establish differentiated norms and assess the rationality of water use at each industrial enterprise.

To be able to - determine the average specific water consumption and the amount of wastewater in the production of industrial products, calculate the water balance.

**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**

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 28 of 41
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CODE: HYD241

CREDIT - 3 (2/0/1)

PREREQUISIT - 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 master student 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.

**Theoretical foundations of ensuring the microclimate of premises**

CODE: HYD244

CREDIT - 3 (2/0/1)

PREREQUISIT - physics, mathematics1, mathematics2, building materials, thermodynamics.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The acquisition by undergraduates of theoretical knowledge and practical skills necessary to understand the processes and phenomena associated with the consideration of the thermophysical foundations of the transfer of heat, moisture through the building envelopes of the air regime of the building, regulation of the thermal regime using modern concepts of the theory of heat and mass transfer.

**SHORT DESCRIPTION OF THE COURSE**

The aim of the discipline "Theoretical foundations of creating a microclimate in a room" is a systematic presentation of the provisions that represent a theoretical basis for studying the technology of providing microclimate. Therefore, the generalization of that part of the results that reveal the essence of the processes of microclimate formation seems to be the main task of this discipline.

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

As a result of studying the discipline, undergraduates must

Know:

- the main provisions of SNiP RK 2.04-03-2002, on the determination of various indicators and regulatory requirements for the selection of the required parameters;
- basic information about the thermal regime of the building; heat exchange in the room;
- heat exchange by radiation between the surfaces of the room;
- convective heat exchange and air movement in the room;
- thermal balance of air in the room; stationary and non-stationary heat transfer through the fence;
- thermal conductivity and moisture conditions of the enclosure;
- the air regime of the building and the air permeability of the enclosing structures;
- winter and summer thermal conditions;
- heat resistance of the room;
- thermal conditions of the premises and microclimate conditioning systems in conditions of round-the-clock operation;
- methods and schemes for reducing heat loss through building elements;

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 30 of 41
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- types and designs of main building elements, fences and windows;
- the basis for calculating the determination of various parameters of fences that provide

reduction of heat losses and selection of modern fencing designs.

Be able to:

- to select and justify the choice of design external conditions for modern enclosing structures of residential buildings and structures (civil, industrial);
- to design and evaluate fences from the standpoint of the reliability of protection of premises from external climatic influences and the preservation of a given temperature and humidity regime inside them;
- to develop measures to save heat energy;
- choose the optimal heat engineering parameters of fences;
- to determine the main parameters of heat protection devices to ensure their efficient operation;
- to choose modern energy-saving fences that provide a reduction in heat loss and the necessary comfortable conditions in the premises.

**Innovative technologies in water supply and sewerage systems of industrial enterprises**

CODE: HYD232

CREDIT - 3 (2/0/1)

PREREQUISIT - chemistry, physics, mathematics, hydraulics.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the discipline is to give an idea of innovative technologies in water supply and sewerage systems of industrial enterprises.

**SHORT DESCRIPTION OF THE COURSE**

"Innovative technologies in water supply and sewerage systems of industrial enterprises" gives an idea of modern methods and designs of natural and waste water treatment facilities. Study of the theoretical foundations of drinking water treatment technologies, calculations of structures and design of natural water purification schemes. Calculations to determine the productivity and operating mode of structures.

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

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

Know:

- types of innovative technologies in water supply and sewerage systems of industrial enterprises
- establishment of the concepts and essence of water use, water consumption and protection of water resources;
- main problems of natural and waste water treatment in the Republic of Kazakhstan;
- methods and schemes of natural and waste water treatment;



**Rational use of heat and gas in construction**

CODE: HYD238

CREDIT - 3 (2/0/1)

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

**PURPOSE AND OBJECTIVES OF THE COURSE**

Study of the issues of rational use of heat and natural gas in construction.

**SHORT DESCRIPTION OF THE COURSE**

Physicochemical properties of combustible gases, structure and main directions of gas use, rational use of natural gas and combustible air using a modern fuel distribution system.

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

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

Know:

- rational use of natural gas in industrial furnaces for various purposes;
- constructive and gas-dynamic calculation of gas burner devices.

Be able to:

- to choose a solution to the issues of choosing the optimal gas supply systems for industrial furnaces and installations;
- to apply the rational use of natural gas heat;
- choose modern designs of gas burners;
- analyze the thermal operation of the gas-using unit.

**Modern technologies for the reconstruction of water supply and sewerage systems and structures**

CODE: HYD240

CREDIT - 3 (2/0/1)

PREREQUISIT - physics, chemistry, water chemistry and myrobiology, 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 is to give an idea of modern technologies in the reconstruction of water supply and sewerage systems.

**SHORT DESCRIPTION OF THE COURSE**

"Modern technologies in the reconstruction of water supply and sewerage systems" is the acquisition of theoretical knowledge and practical skills by undergraduates on the basics of reconstruction and intensification of engineering systems of water supply and sanitation, familiarization of undergraduates with the problems of water consumption in the Republic of Kazakhstan, study of the content of water consumption in economic sectors.

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

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

- establishment of the concepts and essence of water use, water consumption and protection of water resources;
- subject and objectives of the discipline "scientific research on integrated water use";
- 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;

Be able to:

- use the knowledge of the course for research on integrated water use and solving modern and future issues of water consumption and wastewater disposal in the Republic of Kazakhstan

**Methods and tools for research of heat engineering processes**

CODE: HYD234

CREDIT - 3 (2/0/1)

PREREQUISIT - physics, chemistry, mathematics, hydraulics and aerodynamics, heat and mass transfer, heat generating installations, heating, ventilation, air conditioning, gas supply, heat supply.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The general task of studying the discipline is to train specialists - masters for work in the field of construction in the specialization "Heat and gas supply and ventilation"

**SHORT DESCRIPTION OF THE COURSE**

"Methods and tools for the study of heat engineering processes" - the study of the theoretical foundations, techniques and methods for measuring the numerical values of parameters characterizing heat engineering processes - temperatures, pressures, costs and composition of liquid vapor-gas media. levels of liquids and bulk materials, etc., conditions of use and basic design diagrams of measuring transducers, measuring instruments and measuring instruments.

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

As a result of studying the discipline, undergraduates must:

know: -classification of measuring instruments, basic metrological concepts, methods for assessing the accuracy of measurements and errors in determining the numerical values of parameters, the device and principle of operation of media for measuring temperatures, pressures, flow rates of gas, vapor liquid means levels of liquids and bulk materials, composition of gases, concentrations of salt solutions , acids and alkalis, be able to: calculate the values of measurement errors, apply in practice the methods of measuring temperatures, pressures and flow rates of steam, gas and liquid media, calculate the orifice devices of variable pressure drop flow meters, apply methods for measuring the levels of various media and bulk materials, as well as heat consumption in heating systems.

**Methods and tools for studying water purification processes**

CODE: HYD263

CREDIT - 3 (2/0/1)

PREREQUISIT - technology for improving water quality, surface and underground water resources, equipment and technology for water purification.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline is to form a complex of knowledge and skills using a modern method of research on the quality of water purification processes.

**SHORT DESCRIPTION OF THE COURSE**

Study and application of modern methods of control over the composition of water purification processes.

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

As a result of studying the discipline, undergraduates must:

know:

- methods of chemical, physical and biological analyzes of water purification.
- use modern equipment for water analysis;
- conduct research on the composition and quality of water;
- analyze the results obtained.

be able to:

- to carry out control measurements of the quality of the purified water purification, analyze and apply the obtained results in practice.

**Adjustment and reconstruction of heat supply systems**

CODE: HYD207

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**

Developed:	Discussed: meeting of the INSTITUTE	Approved: E&MB of Satbayev University	Page 36 of 41
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Basic solutions for the reconstruction of modern heat supply systems. Adjustment and operation of urban and industrial heat supply systems. Technique of hydraulic calculations of heating networks. Heating and pumping equipment in heat supply systems. Development of piezometric graphs with pumping stations. Requirements for hydraulic modes during the operation of heat supply systems. Basics of reliability in the operation of heat supply systems. Hydraulic stability of heat supply systems. Modern technologies for designing the installation of heat supply systems.

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

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

know - schemes of heating networks; the structure of heat supply systems; types and characteristics of consumers and sources of heat; methods of laying heating networks and their structural elements; devices and equipment for setting up heating networks; the main problems in the reconstruction of heat supply systems.

be able to - apply in practice the theoretical knowledge and skills acquired; use methods for determining the calculated indicators of heat supply; use modern technologies and devices in the adjustment and reconstruction of heat supply systems, taking into account reliability.

**Start-up and adjustment of water supply and sewerage facilities**

CODE: HYD216

CREDIT - 3 (2/0/1)

PREREQUISIT - mathematics, physics, chemistry, water supply, sewerage, drainage systems of industrial enterprises, rational use of water, closed water supply systems and operation of water supply and sewerage systems.

**PURPOSE AND OBJECTIVES OF THE COURSE**

The aim of the course is to improve the efficiency of water supply and sanitation systems. The following means in the water supply system: mixers, charcoal sludge and filter intensities and starts.

**SHORT DESCRIPTION OF THE COURSE**

The discipline "Start-up and adjustment of water supply and sewerage facilities" gives an idea of the theoretical foundations and basic provisions of reconstruction, intensification and improvement of the efficiency of water supply systems, as well as environmental protection.

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

As a result of studying the discipline "Start-up and adjustment of water supply and sewerage facilities", the master student should know:

- how to increase the efficiency and productivity of treatment facilities of the water supply and sewerage system on the basis of reconstruction, intensification and improvement of engineering systems of structures and structures, as well as to know the basics of commissioning and adjustment of facilities for water supply and sewerage systems;
- techniques and methods for performing elements of intensification, reconstruction and modernization of engineering systems and water supply facilities;
- how to carry out intensification, reconstruction and modernization engineering systems and water supply facilities;
- basics of commissioning and adjustment of water supply and sewerage facilities;
- how to reduce the consumption of material resources, as well as promote rational use and protection from pollution by wastewater.
- In addition, the undergraduate must be able to:
- own the latest achievements of science and technology in the field of engineering systems of water supply and sanitation;

- use methods for determining the design parameters of the processes of intensification and reconstruction of engineering systems and structures, as well as know the basics of commissioning and adjustment of structures for water supply and sewerage systems;
- be familiar with the features of improving engineering systems and structures, regarding the operation of water supply and sewerage systems.

**Master's thesis defense**

CODE – ECA203

CREDIT – 7

The purpose of the master's thesis is:

demonstration of the level of scientific/research qualification of undergraduates, the ability to independently conduct scientific research, testing the ability to solve specific scientific and practical problems, knowledge of the most common methods and techniques for their solution.

**BRIEF DESCRIPTION**

Master's thesis – final qualifying scientific work, which is a synthesis of the results of independent research undergraduate one of the actual problems of a particular specialty of the relevant branch of science, which has internal unity and reflects the progress and results of the development of the chosen topic.

Master's thesis – the result of the research /experimental research work of the undergraduate, conducted during the entire period of study undergraduate.

Pre-design studies of the object of dissertation research; conducting field and research and design studies; attribution of the building as an object of material culture, the definition of its artistic, historical value, technical condition and degree of preservation; the choice of the optimal model of restoration of the object of material culture, the development of scientific and design documentation necessary for the restoration and adaptation of the monument for modern use. Demonstration of acquired knowledge and skills in development in the field of protection, restoration and reconstruction of architectural heritage.

The defense of the master's thesis is the final stage of the master's degree.

Master's thesis must meet the following requirements:

- the work should be carried out research or solve current problems in the field of architecture and urban planning;
- the work should be based on the identification of important scientific problems and their solution;
- decisions should be scientifically grounded and reliable, have internal unity;
- dissertation work should be written alone



## Content

1 Scope and content of the program	5
2 Requirements for applicants	6
3 Requirements for completing studies and obtaining a diploma	7
4 Working curriculum of the educational program	9
5 Modular educational program	11
6 Descriptors of the level and amount of knowledge, abilities, skills and competencies	13
7 Completion competencies	13
8 Annex to the certificate according to the standard ECTS	17