



Institute of Architecture and Construction named after T.K. Basenov

Department of "Engineering systems and networks"

EDUCATIONAL PROGRAM

7M07311 "Engineering systems and networks"

Code and classification of the field of education: **7M07 Engineering, manufacturing and civil engineering**

Code and classification of training directions: **7M073 Architecture and civil engineering**

Group of educational programs: **M127 Engineering systems and networks**

Level based on NQF: 7

Level based on IQF: 7

Study period: 1,5 years

Amount of credits: 90

Almaty 2022

Educational program 7M07311 "Engineering systems and networks" was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes # 13 dated «28» 04 2022.

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council.

Minutes # 7 dated «26» 04 2022.

Educational program 7M07311 «Engineering systems and networks» was developed by Academic committee based on direction «Architecture and civil engineering»



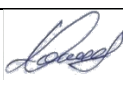

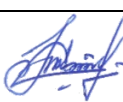

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Alimova Kulyash Kabpasovna	Candidate of Technical Sciences	Head of the Department, associate professor	Department of "Engineering systems and networks", Institute of Architecture and Construction named after T.K. Basenov	
Teaching staff:				
Khalkhabai Bostandyk	Candidate of Technical Sciences, docent	Associate professor	Department of "Engineering systems and networks"	
Khoishiev Amirkhan Nurdinuly	Candidate of Technical Sciences	Associate professor	Department of "Engineering systems and networks"	
Employers:				
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Students				
Shalkar Saken Satbayuly		master's student	1 course	
Bayarystanov Madiyar Malikovich		student	4 course	

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List of abbreviations and designations

NJSC KazNRTU named after K.I.Satbayev - Non-profit Joint Stock Company
"Kazakh National Research Technical University named after K.I.Satpayev";
SCSE – State compulsory standard of education of the Republic of Kazakhstan;
EP – educational program;
SIS – student independent study (student, master student, doctoral student);
TSIS – independent work of a student with a teacher (student, master student, doctoral student)
WC – working curriculum;
CED – catalog of elective disciplines;
UC – university component;
CC – component of choice;
NQF – national qualifications framework;
IQF – industry qualifications framework;
LO – learning outcomes.

1. Description of educational program

Within the framework of the Master's degree specialty, the university independently develops various educational programs in accordance with the National Qualification Framework, professional standards and agreed with the Dublin descriptors and the European Qualification Framework. Educational programs should be focused on learning outcomes. Dublin descriptors, which are a description of the level and scope of knowledge, skills, skills and competencies acquired by undergraduates upon completion of the educational program of each level (stage) of higher and postgraduate education, are based on learning outcomes, formed competencies, as well as the total number of ECTS credit (credit) units. The structure of the Master's degree program is formed from various types of educational and scientific work that determine the content of education, and reflects their relationship, 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 training space for OP 7M07311 "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, who are able to quickly adapt to rapidly changing market conditions and innovative trends. The list of elective component disciplines 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 7M07311 "Engineering systems and networks" can perform the following types of professional activities: - Design and technical and economic; - organizational and managerial; - production, technological and operational; - legal, expert and consulting; - experimental research.

Specific types of activities are determined by the content of the educational and professional program developed by the university. Developed: Reviewed: meeting of the Institute's Management Committee Approved: KazNRTU Management Committee Page 4 of 40 Organizational and managerial activities: - organization of the work of the labor collective of performers with the creation of 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 over staffing, wages, cost and quality of performance of various types of work, ensuring the safety of life, labor protection and compliance with environmental safety in production 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 solving technological problems encountered in the production process; - effective use of materials and raw materials, equipment, machinery, modern computer programs for

calculations and design of technological process parameters; - engineering and technical operation 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; - ability to navigate the current legislation and the ability to apply certain legal norms in practice; - conducting expertise and providing consulting assistance in various industrial situations.

2. Purpose and objectives of educational program

Purpose of EP: 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 under the educational program 7M07311 "Engineering Systems and networks" (profile direction) through the implementation of the principles of the Bologna process and modern quality standards.

Tasks of EP: The training of specialists is aimed at participating in design work, as well as performing work on the operation and installation of heating, ventilation and air conditioning systems, water supply, sewerage, heat supply, gas supply and boiler houses, as well as the reconstruction of these systems.

3. Requirements for evaluating the educational program learning outcomes

A graduate who has mastered master's degree programs should 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 the sequence of solving professional tasks;
- the ability to apply in practice the knowledge of fundamental and applied sections of disciplines that determine the orientation (profile) of the master's degree program;
- the ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems;
- the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities;
- proficiency in the preparation and execution of 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 orally and in writing in a foreign language to solve the tasks of professional activity.

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

- production activities:
 - the ability to independently carry out production, field and laboratory and interpretive work in solving practical problems;
 - the ability to professionally operate modern field and laboratory equipment and devices in the field of the master's degree program;
 - the ability to use modern methods of processing and interpreting complex information to solve production problems;
- project activities:
 - the ability to independently draw up and submit projects of research and scientific-production works;
 - readiness to design complex research and scientific-production works in solving professional tasks;
- organizational and managerial activities:
 - readiness to use practical skills of organization and management of research and scientific-production works in solving professional tasks;
 - readiness for the practical use of regulatory documents in the planning and organization of scientific and production work;

When developing a master's degree 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 focuses on, are included in the set of required results of mastering the master's program

Requirements for the key competencies of graduates of the profile master's degree, must:

- 1) have an idea:
 - about current trends in the development of scientific knowledge;
 - on current methodological and philosophical problems of natural (social, humanitarian, economic) sciences;
 - contradictions and socio-economic consequences of globalization processes;
 - about the current state of the economic, political, legal, cultural and technological environment of the global business partnership;
 - about the organization of strategic enterprise management, innovation management, leadership theories;
 - about the main financial and economic problems of the functioning of enterprises.
- 2) know:
 - methodology of scientific knowledge;
 - the main driving forces of changing the structure of the economy;
 - features and rules of investment cooperation;
 - at least one foreign language at a professional level that allows conducting scientific research and practical activities.
- 3) be able to:
 - apply scientific methods of cognition in professional activity;
 - critically analyze existing concepts, theories and approaches to the study of processes and phenomena;

- integrate the knowledge gained in different disciplines, use them to solve analytical and managerial tasks in new unfamiliar conditions;
- conduct microeconomic analysis of the economic activity of the enterprise and use its results in the management of the enterprise; – apply in practice new approaches to the organization of marketing and management;
- to make decisions in complex and non-standard situations in the field of organization and management of economic activity of the enterprise (firm);
- to apply in practice the norms of the legislation of the Republic of Kazakhstan in the field of regulation of economic relations;
- to think creatively and creatively approach the solution of new problems and situations;
- to carry out information-analytical and information bibliographic work with the involvement of modern information technologies;
- to summarize the results of experimental research and analytical work in the form of a master's thesis, an article, a report, an analytical note, etc.

4) have skills:

- solutions to standard scientific and professional tasks;
- scientific analysis and solution of practical problems in the organization and management of economic activities of organizations and enterprises;
- research problems in the field of management and marketing and use the results to improve the methods of enterprise management;
- professional communication and intercultural communication;
- oratory, correct and logical formalization of their thoughts in oral and written form
- expansion and deepening of knowledge necessary for daily professional activity and continuing education in doctoral studies; – use of information and computer technologies in the field of professional activity.

5) be competent:

- in the field of research methodology in the specialty;
- in the field of modern problems of the world economy and the participation of national economies in world economic processes;
- in the organization and management of the company's activities;
- in the implementation of industrial relations with various organizations, including public service bodies;
- in ways to ensure constant updating of knowledge, expansion of professional skills and abilities.

B – Basic knowledge, skills and abilities

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

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

B3 - possess the skills to acquire new knowledge necessary for professional activity and continuing education in the master's degree. P – Professional competencies:

P2 - Is able to logically represent the acquired knowledge and understanding of systemic relationships within disciplines, as well as interdisciplinary relations in modern times. He is able to build technologies for teaching new knowledge. Knowledge of energy- and resource-saving technologies and the ability to apply them in engineering systems.

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

P4 - The ability to assess the quality and types of professional activities by experts. Willingness to work independently, the ability to manage your time, plan and organize activities.

P5 - Readiness for continuous self-development, the ability to build strategies for personal and professional development of training. It is able to determine the operating modes of the equipment of engineering systems and networks.

P6 - Is able to calculate and select the equipment of engineering systems and networks. Capable of correctly and safely operating the equipment of engineering systems and networks. Knowledge of the basics of operation of engineering systems, networks and their equipment.

P7 - Is able to independently master new equipment, technological and technical documentation. Knowledge of the requirements of safety regulations, labor protection and environmental protection from the harmful effects of production and the ability to use them in practice. Knowledge of the theoretical foundations of processes occurring in engineering systems. Knowledge of experimental research planning methods.

O - Universal, socio-ethical competencies.

O1 - To know at least one foreign language at a professional level, allowing to carry out practical activities.

O2 - To have an idea of the main financial and economic problems of the functioning of enterprises. Ability to perform analysis in the field of project management and business.

O3 - Knowledge and understanding of professional ethical standards, mastery of professional communication techniques.

Ability to build interpersonal relationships and work in a group (team) C – Special and managerial competencies:

C1 - have the skills of professional communication and intercultural communication, public speaking, correct and logical formalization of their thoughts orally and in writing

C2 - be able to economically justify and solve issues related to the organization of the production process, determine the volume and quality performance of engineering systems, process and analyze the results of theoretical and experimental studies on the technical level and operational condition of engineering systems and structures

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M07 Engineering, manufacturing and civil engineering
2	Code and classification of training directions	7M073 Architecture and civil engineering
3	Educational program group	M127 Engineering systems and networks
4	Educational program name	7M07311 Engineering systems and networks
5	Short description of educational program	Within the framework of the Master's degree specialty, the university independently develops various educational programs in accordance with the National Qualification Framework, professional standards and agreed with the Dublin descriptors and the European Qualification Framework. Educational programs should be focused on learning outcomes. Dublin descriptors, which are a description of the level and scope of knowledge, skills, skills and competencies acquired by undergraduates upon completion of the educational program of each level (stage) of higher and postgraduate education, are based on learning outcomes, formed competencies, as well as the total number of ECTS credit (credit) units. The structure of the Master's degree program is formed from various types of educational and scientific work that determine the content of education, and reflects their relationship, measurement and accounting.
6	Purpose of EP	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 training space in the specialty 7M07311 "Engineering systems and networks" through the implementation of the principles of the Bologna Process and modern quality standards.
7	Type of EP	New
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	no
11	List of competencies of educational program	Professional competencies; Basic knowledge, skills and abilities; Universal, social and ethical competencies; Special and managerial competencies
12	Learning outcomes of educational program	LO1 Apply scientific methods of knowledge in professional activities. LO2 Critically analyze existing concepts, theories and approaches to the study of processes and phenomena.. LO 3 Integrate knowledge gained in different disciplines to solve research problems in new unfamiliar conditions.

		<p>LO 4 To conduct a microeconomic analysis of the economic activity of the enterprise and use its results in the management of the enterprise.</p> <p>LO 5 To put into practice new approaches to the organization of marketing and management..</p> <p>LO 6 Make decisions in complex and non-standard situations in the field of organization and management of the economic activity of an enterprise (company).</p> <p>LO 7 Think inventively and creatively to solve new problems and situations.</p> <p>LO 8 To carry out information-analytical and information-bibliographic work with the involvement of modern information technologies.</p> <p>LO 9 Summarize the results of experimental research and analytical work in the form of a master's thesis, article, report, analytical note, etc..</p>
13	Education form	Full - time
14	Period of training	1,5
15	Amount of credits	90
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Master of Engineering and Technology
18	Developer(s) and authors	Alimova K., Khoishiev A., Omarova L.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)								
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CYCLE OF BASIC DISCIPLINES												
University component												
1	English language (professional)	The course is aimed at developing vocabulary and grammar for effective communication in the field of project management and improving reading, writing, listening and speaking skills at the Intermediate level. It is expected that students will acquire and replenish their vocabulary of business English and study grammatical structures that are often used in the context of management. The course consists of 6 modules.	2	✓			✓				✓	
2	Management	The course provides an overview of business and management both in the field of theoretical development and practical activity. It includes an examination of classical management theories and modern approaches to organizations and business conduct. The main blocks of the course are management functions that link management processes and the interaction between the organization and the external environment.	2				✓	✓			✓	
3	Psychology of management	The discipline "Psychology of management" deals with the problems of managerial decision-making in the conditions of practical work of the organization. The relationship of the manager with the staff, the ways of their productive cooperation, methods of conflict resolution are analyzed, special attention is paid to group dynamics, negotiation processes and decision-making technology. Management psychology as a science relies on various psychological methods.	2		✓			✓		✓	✓	
CYCLE OF BASIC DISCIPLINES												
Component of choice												
4	Information technology engineering systems	A review of information systems of various classes used for the design and information support of utilities is conducted. Such classes of products as geo-information systems, computer-aided design systems, and also specialized systems are considered. Criteria are put forward for practical suitability of systems and their joint assessment is carried out.	4		✓	✓				✓		

5	Innovative technologies for natural and waste water treatment	The purpose of the study of disciplines is the development of innovative technologies that allow to improve the quality of purification of natural and wastewater from anthropogenic pollution, complex forms of organic and inorganic using the methods of oxidation of sorbent technologies..	4			✓	✓		✓	✓		
6	Water-saving technologies for water consumption and wastewater disposal of industrial enterprises	The discipline studies the issues of water resources, the principles of saving water resources at industrial enterprises and the use of water-saving technologies.	5	✓	✓		✓	✓			✓	
7	Heat generators with increased energy efficiency	In the course of studying the discipline "Heat generators with increased energy efficiency", undergraduates study the current state of heating, ventilation and hot water supply systems.	5	✓		✓				✓		
CYCLE OF PROFILE DISCIPLINES												
University component												
8	Methods for calculating the energy efficiency of buildings and structures	Methods for calculating the energy efficiency of buildings and structures. It gives an idea about energy resources and the principles of their economy, energy saving methods in heat generating plants, heating and ventilation systems, the principles of underground coal gasification, the use of renewable energy resources, energy technology waste use and energy production at nuclear power plants.	5	✓		✓				✓		
9	Rational use of energy resources	The rational use of energy resources studies energy conservation (energy saving) - the implementation of legal, organizational, scientific, industrial, technical and economic measures aimed at the efficient (rational) use (and economical use) of fuel and energy resources and the involvement of renewable sources in the economic turnover.	5			✓		✓		✓		
10	Production practice	Industrial practice ensures the consolidation of knowledge and skills acquired during theoretical training, is an intermediate link between the studied disciplines and preparation for the defense of master's theses	5	✓				✓		✓		
CYCLE OF PROFILE DISCIPLINES												
Component of choice												
11	Actual problems of modern water supply and sewerage systems	The discipline studies the actual problems of modern water supply and sewerage systems. The issues related to the increased requirements for natural and wastewater treatment systems are being studied, as well as issues of increasing the load on treatment facilities that arise due to an increase in their productivity.	5	✓	✓		✓				✓	
12	Topical problems of modern heat and gas supply and ventilation systems	The discipline studies the actual problems of modern heat and gas supply and ventilation systems, the tasks of providing an expanded outlook, the possibility of deeper improvement of specialized issues of professional activity in the field of heat and gas supply and ventilation.	5	✓	✓		✓				✓	

13	Start-up and adjustment of water supply and sewerage facilities	The discipline "Commissioning and commissioning of water supply and sewerage facilities" studies the rules for commissioning and commissioning of facilities, highlights the issues of monitoring the operation of facilities and their technical characteristics.	5	✓				✓		✓		✓
14	Rational use of heat and gas in construction	The purpose of teaching the discipline is to acquire the knowledge and practical skills necessary to understand the rational use of heat and gas during construction, gas fuel supply systems, ensure uninterrupted gas supply and heat supply, taking into account the operation of the main and auxiliary equipment, rational consumption of gas fuel based on the use of modern science and technology, taking into account the development prospects of the gas industry and heat supply systems	5	✓		✓			✓			✓
15	Systems of protection of water resources	The purpose of the discipline is to study the concepts and principles of water use, protection of water resources, the study of methods of protection of water resources, in order to preserve the qualitative and quantitative composition of water resources.	5		✓	✓					✓	
16	The economy of heat and energy in heat and gas supply and ventilation systems	The economy of heat and energy in heat and gas supply and ventilation systems. Methods of saving heat and energy in boiler plants, heating, ventilation, air conditioning and cooling systems, the device and the principle of operation of systems using solar and geothermal energy for the heat supply of domestic and industrial consumers and methods for assessing the effectiveness of energy-saving measures.	5	✓	✓		✓	✓				
17	Modern computer calculations of heat supply, gas supply and ventilation systems	In the process of studying the discipline, future specialists are preparing to solve problems on computers of heat and gas supply and ventilation systems, taking into account the modern achievements of various areas. It serves as the basis for preparing the undergraduate to master the elements of the methodology of scientific research, contributes to the development of creative thinking; organization of the optimal mental activity of the future undergraduate in the field of heat and gas supply and ventilation.	5						✓	✓		✓
18	Modern computer calculations of water supply and sewerage systems	In the course of studying the discipline, masters study modern computational computer programs and modeling of processes and structures, in order to effectively select equipment and structures.	5						✓	✓		✓
19	Modern methods modernization of water treatment facilities	The purpose of teaching the discipline is to form a set of knowledge and skills on the use of methods for modernizing water treatment facilities in the context of increasing the productivity of treatment facilities associated with population growth and industrial development.	5	✓		✓	✓			✓		
20	Adjustment and reconstruction of heat supply systems	Adjustment and reconstruction of heat supply systems. The basic decisions on reconstruction of modern systems of a heat supply. Adjustment and operation of city and industrial systems of a heat supply. Techniques of hydraulic calculations of thermal networks. The thermal	5					✓		✓		✓

		and pump equipment in heat supply systems. Working out пьезометрических schedules with pump stations. Requirements to hydraulic modes at operation of systems of a heat supply. Reliability bases at operation of systems of a heat supply. Hydraulic stability of systems of a heat supply. Modern technologies designing of installation of systems of a heat supply.										
21	Actual problems of operation of modern systems of heat supply, gas supply and ventilation	In the course of studying the discipline, undergraduates should receive information about the current state of housing and communal services; about the management of the municipal sector of cities and settlements; about methods of reducing heat losses and monitoring the effective use of heat in heat and gas supply and ventilation systems; about the rules of operation of internal engineering systems and external networks.	5	✓		✓		✓		✓		
22	Actual problems of operation of modern water supply and sewerage systems	In the process of studying the discipline, specialists solve problems in conditions of increasing regulatory requirements for purified water of water supply and sewerage systems, in order to determine effective technological parameters of system equipment and save resources in operation.	5	✓		✓		✓		✓		

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