

Ministry of Agriculture of the Republic of Kazakhstan
S. Seifullin Kazakh agrotechnical University

The Academic Council of the University
considered

2022 « 13 » 05
protocol № 14

Approve

Chairman of the board of JSC

"Kazakh Agrotechnical University" after S. Seifullin

K.K. Aituganov



EDUCATIONAL PROGRAM
7M07102 Heat and gas supply and ventilation in AIC

Code and classification of the field of education:

7M07 "Engineering, manufacturing and construction industries"

Code and classification of training areas:

7M071 Engineering and engineering trades

The international standard classification of education
code: 0710

Qualification: master's degree in the educational program

7M07102 Heat and gas supply and ventilation in AIC

Training period: 2 years

Astana 2022

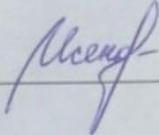
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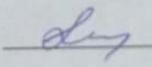
JSC named after S. Seifullin "KATU" No. 932 dated 12.12.2018, the author's team was approved by the order.

Considered at the meeting of the Department of heat power engineering,
Protocol No. 1 of "27" 08.2022

Approved by the Council of the Faculty of energy,
Protocol No. "" _ _ _ _ 2022

Dean of the Faculty of energy  Isenov S.S.

Head of the department "Heat Power
Engineering"

 Mergalimova A.K.

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1 Passport of the educational program

1.1 Purpose of the educational program

The main goal of the educational program "**Heat and gas supply, ventilation in the agro-industrial complex**" is to train qualified specialists who are in demand on the labour market, possessing scientific, pedagogical and professional competencies following the requirements of the National Qualifications Framework and the Sectoral Qualifications Framework of the Republic of Kazakhstan, to carry out professional activities in the framework of ensuring quality functioning and improvement of heat and gas supply, ventilation and air conditioning systems at the facilities of the agro-industrial complex.

The main objectives of the educational master's program "**Heat and gas supply and ventilation in the agro-industrial complex**" :

- to provide an individual educational trajectory of training following the specialization chosen by undergraduates;
- to provide a full-fledged and high-quality scientific and pedagogical education, to form professional competence, to deepen theoretical and practical, as well as individual training of undergraduates in the field of technical regulation ;
- to promote undergraduates to obtain the most important and sustainable knowledge that provides a holistic perception of the world;
- to develop in students the ability to self-improvement and master new knowledge;
- train specialists with a high level of professional culture (including the culture of professional communication), who have a civil position, can formulate and solve modern scientific and practical problems, teach at universities, and successfully carry out research and management activities;
- to ensure the development of fundamental courses at the intersection of sciences that guarantee professional mobility;
- to promote the acquisition of skills to participate in scientific events at various levels, the continuation of scientific training in doctoral studies;
- ensure the acquisition of the necessary amount of knowledge in the field of university pedagogy and psychology and the acquisition of teaching experience at a university.

The ultimate goal of the program is to train competitive specialists in the field of heat and gas supply and ventilation in the agro-industrial complex (AIC), able to take part in the implementation of a technological breakthrough in the economy of the Republic of Kazakhstan.

2 General characteristics of the educational program

Currently, by several state programs for the development of agriculture, the preparation of a master's degree in EP is very relevant." **Heat and gas supply, ventilation in the agro-industrial complex**", capable of performing the functional duties of designing, installing and operating buildings and structures,

heat and gas supply and ventilation systems. At the same time, due to the high energy costs and technological backwardness of this industry, it is very important to train modern highly qualified personnel to carry out professional activities following the requirements of employers and based on the needs of the labour market.

The modular educational program "**Heat and gas supply and ventilation in the agro-industrial complex**" were developed by the National Qualifications Framework and aligned with the Dublin Descriptors and the European Qualifications Framework. The educational program is designed based on a modular system for studying disciplines and contains 5 modules that form general cultural and professional competencies.

The modular educational program "Heat and gas supply and ventilation in the agro-industrial complex" provide for the study of the following cycles:

- theoretical training in cycles of basic and major disciplines;
- additional types of training: pedagogical, research practice;
- undergraduate research work, including the implementation of a master's thesis ;
- final state certification in the form of passing the state exam in the speciality and preparing and defending the final work of the master.

normative term for mastering a modular educational program for the scientific and pedagogical direction of education is 2 years.

The labour intensity of mastering the modular educational program for undergraduates indicated in credits for the entire period of study by the State Educational Standard of the Republic of Kazakhstan in the direction of training **Heat and gas supply, ventilation in the agro-industrial complex**, including all types of classroom and independent work of the student, practice, and the time allotted for quality control in full-time education is 120 loans, including:

74 credits for the study of academic disciplines, 10 credits for all types of practices (teaching practice - 5 credits, research practice - 5 credits)and research work of a master student - 24 credits, 12 credits for the final certification.

3 Competence model (portrait) of a graduate

3.1 Areas of professional activity:

The sphere of professional activity of graduates is the systems of heat and gas supply, ventilation, air conditioning and air purification from industrial pollution of objects of the agro-industrial complex (AIC).

The subjects of professional activity of the bachelor in the educational program "**Heat and gas supply and ventilation in the agro-industrial complex**" are:

- maintenance, repair of heat and gas supply and ventilation systems, heating systems;
- maintenance, and repair of small industrial and heating boilers in agriculture ;

- installation and operation of the gas supply system for industrial and agricultural enterprises;
- installation and operation of centralized and autonomous heat supply to industrial enterprises and organizations;
- maintenance, and repair of installations for the production and distribution of energy carriers in public and industrial buildings and structures;
- maintenance, and repair of heating and heating networks;
- construction industry;
- participation in the design of heat and gas supply and ventilation systems, and heating systems.

Objects professional activities of the graduate are:

- systems of heat and gas supply, ventilation, air conditioning and air purification from industrial pollution of industrial facilities and agricultural sectors;
- systems of heat and gas supply of industrial enterprises;
- systems of heat and gas supply of autonomous objects;
- design of systems for heat and gas supply, ventilation, air conditioning and air purification of residential, public and industrial buildings and structures;
- power plants and complexes based on non-traditional and renewable energy sources;
- technological installations for the production, distribution and use of heat;
- installations for the production of compressed and liquefied gases, compressors, refrigeration and cryogenic installations, installations of air conditioning systems, and heat pumps;
- auxiliary heat engineering equipment, heat and mass transfer apparatus for various purposes;
- heating network;
- installations for conditioning heat carriers and working fluids;
- technological installations for the preparation and use of water from heating networks and heating consumers;
- water recycling systems;
- real estate objects, land plots, urban areas, transport infrastructure facilities;
- objects of urban infrastructure and housing and communal services;
- machines, equipment, technological complexes and automation systems used in the construction, operation, maintenance, repair and reconstruction of construction sites and housing and communal services, as well as in the production of building materials, products and structures.
- construction industry;
- systems of automatic control and management of heat-technological processes, installations, systems and complexes;
- regulatory and technical documentation and standardization systems, methods and means of testing equipment and quality control of products sold.

3.2 Types of professional activity:

scientific - research;

- pedagogical;
- operational research;
- production and technological;
- organizational - managerial;
- construction;
- design and engineering.

3.3 General educational competencies:

- Own a culture of thinking, the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it;
- Be able to logically correctly, argued and build oral and written speech;
- Willingness to cooperate with colleagues, and work in a team;
- The ability to find organizational and managerial solutions in non-standard situations and the willingness to bear responsibility for them;
- Be able to use normative legal documents in their activities;
- Strives for self-development, and improvement of their qualifications and skills;
- Be able to critically evaluate their strengths and weaknesses, outline ways and choose means to develop strengths and eliminate weaknesses;
- Recognize the social significance of their future profession, have a high motivation to perform professional activities;
- The ability to analyze socially significant problems and processes;
- Use the basic laws of natural sciences in professional activities, apply the methods of mathematical analysis and modelling, theoretical and experimental research;
- Recognize the essence and significance of information in the development of modern society; own the main methods, ways and means of obtaining, storing, and processing information;
- Have skills in working with a computer as a means of managing information;
- Ability to work with information in global computer networks;
- Be proficient in 1of the foreign languages at a level not lower than spoken;
- Own the basic methods of protecting production personnel and the population from the possible consequences of accidents, catastrophes, and natural disasters;
- Own the means of independent, methodically correct use of methods of physical education and health promotion, and be ready to achieve the proper level of physical fitness to ensure a full-fledged social and professional activity.

3.4 Core competencies:

- conducting scientific research and development in the field of heat and gas supply and ventilation in the agro-industrial complex, energy use and energy supply in separate sections (stages, tasks) of the topic by approved methods;
- development of plans for programs and methods for conducting tests, participating in experiments, conducting observations and measurements, compiling their description and conclusions in the development of modernization and operation of heat power and heat engineering equipment;
- carrying out a technical justification of the decisions made on the development of heating, ventilation and air conditioning systems, heat and gas supply ;
- development of mathematical and simulation models for the functioning of heating, ventilation and air conditioning systems, heat and gas supply ;
- analysis of the state and prospects for the development of heating, ventilation and air conditioning systems, heat and gas supply, using the necessary tools and methods for the design and calculation of heating, ventilation and air conditioning systems, heat and gas supply;
- analysis of the state and dynamics of objects of activity;
- the creation of theoretical models that allow predicting the properties and behaviour of objects of activity;
- use of computer technologies for modelling and processing the results of experimental and theoretical studies;
- development of energy-efficient equipment for heating, ventilation and air conditioning systems, heat and gas supply ;
- use of modelling and optimization methods for heat engineering processes, installations and systems;
- implementation of fundamentally new waste-free processes and complexes of heating, ventilation and air conditioning systems, heat and gas supply ;
- establishing the potential and reserves of energy saving in the industries of production;
- development of new promising systems of heating, ventilation and air conditioning, heat and gas supply ;
- a study of methods for controlling the processes of heat and mass transfer, methods and apparatus for converting various types of energy into heat.

3.5 Professional competencies:

- development of curricula;
- writing methodological developments;
- conducting training sessions with students;
- introduction of modern forms and methods of teaching.
- organizing the work of a team of performers, making management decisions in the face of different opinions;
- finding a compromise between different requirements (to cost, quality, safety and deadlines) both in long-term and short-term planning;

- assessment of production and non-production costs to ensure a given level of product quality;
- implementation of technical control, testing and quality management in the production process.
- organization of maintenance, repair, installation and testing of heating, ventilation and air conditioning systems, heat and gas supply ;
- organization of accounting and regulation of heating, ventilation and air conditioning systems, heat and gas supply ;
- organization of calculations of production estimates, specific costs of energy resources;
- preparation of technical and economic balances of installations, technological processes, sections and the enterprise as a whole;
- energy assessment of thermal circuits and installations;
- monitoring and management of energy flows at the enterprise;
- analysis of production and financial activities of an industrial enterprise;
- organization and management of production and intellectual activities of the workforce.
- control over compliance with production and labour discipline, and life safety requirements; carrying out activities for the environmental safety of the enterprise.
- organization of maintenance, repair, installation and testing of heating, ventilation and air conditioning systems, heat and gas supply ;
- making managerial decisions;
- organization and maintenance of metrological control at the enterprise.

4 Base of professional practice

Undergraduates are sent to the production practice, according to the agreement with the enterprises that are the base of the practice (individual agreements or collective agreements) by the order of the rector on the practice. From KATU n. S.Seifullina is assigned practice leaders for each doctoral student.

Undergraduates of this profile are trained in:

- "National Research Institute for Industrial Safety Problems of the Ministry of Emergency Situations of the Republic of Kazakhstan",
 - Institute of Energy Research of the National Academy of Sciences of the Republic of Kazakhstan,
 - Tomsk Polytechnic University,
 - Warsaw University of Technology (Warsaw University of Technology),
 - Moscow Power Engineering Institute (Technical University),
- and also, at the department, where there is a specialized research laboratory on energy problems. Based on the laboratory, scientific work is carried out within the framework of priority areas - an effective solution to prioritize tasks in the field of energy.

Undergraduates, also, under individual or collective agreements, undergo internships in any industries and enterprises where there is equipment for gas supply, heat supply and heating, ventilation and air conditioning.

Basic passing practice: JSC "Astana Teplotransit", JSC "Astana Energy", GCP of the PHC "Kyzylordateploelectrocenter", GCP of the PHC " Uzen Zyla ", g. Uzen, g. Semey " GKP Teplokommenergo ", city Aktau, GKP "Caspian Heat, Water Channel", as well as construction companies: " BI - Group ", " BIG A ", AIBYNConstructionGroup, OrdaInvest,Nur Astana Kurylysand others.

5The structure of the educational program of the master's program in the speciality" Heat and gas supply and ventilation in the agro-industrial complex " inscientific and pedagogical direction

No. p / p	Name of cycles of disciplines and activities	General labour intensity	
		in academic hours	in academic credits
one	2	3	four
1.	Theoretical training	2520	84
1.1	The cycle of basic disciplines (DB)	1050	35
1)	University component (VC):	600	twenty
	History and philosophy of science	150	5
	Foreign language (professional)	150	5
	Psychology of management	150	5
	Teaching practice	60	2
	Pedagogy of higher education	90	3
2)	Component of choice (CV)	450	fifteen
	Features and prospects for the development of heat and gas supply in the agro-industrial complex	150	5
	Gas turbine units for oil and gas transportation		
	Methods for protecting equipment from corrosion	150	5
	Technical water supply systems		
	Fundamentals of design and construction of pipelines		
	Physical and chemical modelling of heat engineering processes	150	5
1.2	The cycle of major disciplines (PD)	1260	42
1)	University component (VC)	900	thirty
	Scientific and technical problems of heat power engineering and heat technology	150	5
	Diagnostics of maintenance of gas pipeline facilities	180	6
	engineering experiment	120	four
	Energy efficient ventilation and air conditioning systems	150	5
	Approximate methods for solving heat engineering problems	150	5
	Research practice	150	5
2)	Component of choice (CV)	570	19
	Energy management in heat and gas supply	150	5
	Limit Energy Saving Methods		
	Designs of furnace and burner devices for heat supply to buildings and structures	150	5
	Ways of development of low-power boilers		
	Structural materials in heat and gas supply and ventilation	120	four
	Calculations of heat transfer in enclosing structures		
	Heat supply in the agro-industrial complex based on renewable energy sources	150	5
	Obtaining secondary fuel during waste processing		
2	Research work	720	24
1)	Research work of a master's student, including an internship and a master's thesis (NIRM)	720	24
3	Additional types of training (VET)		

four	Final certification (FA)	360	12
1)	Registration and defence of a master's thesis (OiZMD)	360	12
	Total	3600	120

Annexe 3 Description of the disciplines of the compulsory and university components

1. Basic information about the discipline:	
Name of the discipline	History and philosophy of science
2. Number of credits	5
3. Prerequisites:	Philosophy
4. Postrequisites:	Philosophical problems of technology
5. Competencies:	Possess a culture of thinking, the ability to generalize, analyze, and perceive information, including in a foreign language, set a goal and choose ways to achieve it, and the ability to argue and publicly present the results of work. To form the leadership qualities necessary for the effective organization of labour in the working group to achieve a common scientific production result. Be able to use the basic provisions and methods of social, humanitarian and economic sciences in solving personal and professional problems, and use communication skills in Kazakh, Russian and foreign languages at a professional level.
6. Author of the course	Department of Philosophy
7. Basic literature	<ol style="list-style-type: none"> 1. Ts.R.Zaychik, B.Ts.Zaychik. History and philosophy of science and technology. M: Academic project. 2010 - 275s. (24 copies) 2. Stepin V.S. History and philosophy of science. M: Higher school. 2012 - 275s. (12 copies) 3. Shtanko V.I. Philosophy and methodology of science. Kharkiv. Phoenix Publishing. 2002 - 345s. (16 copies).
8. Content of the discipline	
Familiarization of undergraduates with the structure of scientific knowledge, with the methods of scientific research, the functions of scientific theories and laws; expansion of their world outlook; the development of ideas about the criteria of scientific character and the requirements that scientific research and its results must meet, as well as the development of a style of scientific thinking based on the study of the history and philosophy of science.	

1. Basic information about the discipline:	
Name of the discipline	Foreign language (professional)
2. Number of credits	5
3. Prerequisites:	Foreign language (bachelor's degree) (B1-B2) English for special purposes (B1-B2) Vocational-oriented foreign language (B1-B2)
4. Postrequisites:	Disciplines in the speciality in English, English for Academic Purposes
5. Competencies:	Be able to use the basic provisions and methods of social, humanitarian and economic sciences in solving personal and professional problems, and use communication skills in Kazakh, Russian and foreign languages at a professional level.
6. Author of the course	Department of Foreign Languages
7. Basic literature	1. Laurence Anthony (May 18, 2018) Introducing English for Specific Purposes (Routledge Introductions to English for Specific Purposes)

	1st Edition. Routledge 2. John Flowerdew, Tracey Costley (07 Oct 2016). Discipline-Specific Writing: Theory into practice. Taylor & Francis Ltd. 3. by Jackie Stavros, Cheri Torres, David L. Cooperrider (22 May 2018). Conversations Worth Having: Using Appreciative Inquiry to Fuel Productive and Meaningful Engagement. Berrett-Koehler Publishers 4. NadeždaStojković (July 2018) Positioning English for Specific Purposes in an English Language Teaching Context. Vernon Series in Education.
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8. Содержание дисциплины

Setting the language for professional and academic purposes at an advanced level will allow you to freely operate the scientific and conceptual apparatus of the speciality, expand the scientific information base, and master the skills of interpreting scientific information, argumentation, persuasion, scientific controversy, and academic writing.

1. Basic information about the discipline:	
Name of the discipline	Pedagogy highschool
2. Number of credits	3
3. Prerequisites:	Political science and sociology
4. Postrequisites:	Psychology
5. Competencies:	Possess a culture of thinking, the ability to generalize, analyze, and perceive information, including in a foreign language, set a goal and choose ways to achieve it, and the ability to argue and publicly present the results of work. To form the leadership qualities necessary for the effective organization of labour in the working group in order to achieve a common scientific production result. Be able to use the basic provisions and methods of social, humanitarian and economic sciences in solving personal and professional problems, and use communication skills in Kazakh, Russian and foreign languages at a professional level. Possess the skills of pedagogical activity in the disciplines of the direction of the EP, conduct training sessions with students using modern forms and methods of teaching, and develop educational and methodological documentation.
6. Author of the course	Department of Pedagogy
7. Basic literature	1. Bourdieu, P. Practical meaning. - St. Petersburg. : Aletheia, Institute of Experimental Sociology, 2001. 2. Andreev A. A. Pedagogy of higher education: (Applied Pedagogy): Proc. allowance. - M., 2000
8. Content of the discipline	
Formed: knowledge about pedagogical theory and skill, management of the educational process for teaching in higher education, the main categories of pedagogy, the place, role and significance of higher education pedagogy in the system of human sciences and in the practical activities of a teacher; understanding the principles of modern pedagogy and methodological approaches to solving the pedagogical problems of higher education.	

1. Basic information about the discipline:	
Name of the discipline	Psychology of management
2. Number of credits	5
3. Prerequisites:	Political science and sociology, philosophy

4. Postrequisites:	
5. Competencies:	Possess a culture of thinking, the ability to generalize, analyze, and perceive information, including in a foreign language, set a goal and choose ways to achieve it, and the ability to argue and publicly present the results of work. To form the leadership qualities necessary for the effective organization of labour in the working group in order to achieve a common scientific production result. Be able to use the basic provisions and methods of social, humanitarian and economic sciences in solving personal and professional problems, and use communication skills in Kazakh, Russian and foreign languages at a professional level.
6. Author of the course	Department of Pedagogy
7. Basic literature	1 Developmental psychology: childhood, adolescence, youth: Khrestomatiya: Textbook for ped. universities. - M.: Academy, 2011.-624 p. 2 Bourdieu, P. Practical meaning. - St. Petersburg. : Aletheia, Institute of Experimental Sociology, 2001.
8. Content of the discipline	The psychological foundations of effective business communication, professional and organizational interaction, and self-development tools are considered, and the skills of organizing business interaction processes and effective teamwork are instilled. A holistic and systematic idea is formed about the functions of a leader, and the processes of effective organization of labour in a working group in order to achieve a common scientific production result.

Annexe 4 Description of the disciplines of the component of choice

1. Basic information about the discipline:	
Name of the discipline	Scientific and technical problems in heat power engineering and heat technology
2. Number of credits	5
3. Prerequisites:	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	be able to use operating modes of thermal power equipment, determine the most rational parameters, manage the quality and reliability of the functioning of thermal power systems, and methods to reduce equipment corrosion and environmental technologies. Consider the possibilities of developing the industry, incorporating modern, efficient, environmentally friendly, resource- and energy-saving technologies in heat and power systems.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	1. Dikhanbaev B.I., Intensive resource and energy saving in the processing of mineral raw materials, textbook, 2018 2. Fundamentals of energy saving and energy efficiency: textbook. allowance / M. Sh. Aminov; Ministry of Education and Science Rep. Kazakhstan. - Almaty: Bastau, 2015. - 288 p. 3. Energy fuels: abrasiveness and wear [Text]: textbook / A. M. Dostiyarov, G. A. Akimbek, B. T. Bakhtiyar; Ministry of Education and Science of the Republic of Kazakhstan, non-profit joint-stock

	company "Almaty University of Energy and Communications". - Almaty: AEzhBU, 2020. - 218 p.
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8. Content discipline

Scientific and technical problems in the generation and distribution of energy resources, and ways of rational use of various types of energy resources with high efficiency, reliability and safety are considered.

A scientific search is carried out for optimal solutions to problems arising in the generation and distribution of energy, taking into account the requirements of quality, reliability and cost, life safety and environmental cleanliness.

1. Basic information about the discipline:	
Name of the discipline	Ventilation and air conditioning systems
2. Number of credits	6
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Features of heating, ventilation and air conditioning systemsair of agro-industrial facilities sectors
5. Competencies:	As a result of mastering the competence, the student should: know the main directions of development of ventilation and air conditioning systems, the elements of these systems, schemes, equipment, and methods of system design; be able to: make the right choice of solutions for specific buildings for –various purposes, structural elements and their calculation; use modern methods of designing and calculating ventilation and air conditioning systems; –own technical documentation, reading and drawing up design drawings, calculation of air conditioning systems. own methods of designing structures using universal and specialized software and computer systems, and computer-aided design systems.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	Basic educational literature: 1) Semenov, Yu.V. Air conditioning systems with surface air coolers [Electronic resource]: — Electron. Dan. - Moscow: Technosphere, 2014. - 272 p. - Access mode: http://e.lanbook.com/books/element.php?p11_id=73539 - ch. with screen; Additional educational literature: 1) Shumilov R.N., Tolstova Yu.I., Boyarshinova A.N. Design of ventilation and heating systems. [Electronic resource]: - St. Petersburg: Lan, 2014. - Access mode: http://e.lanbook.com .; 2) SP 50. 13330.2012. Thermal protection. - M.: Ministry of Regional Development of Russia, 2012. - Access mode: http://docs.cntd.ru/document/1200095525 ; 3) SP 60.13330.2012. Heating, ventilation and air conditioning. – M.: Ministry of Regional Development of Russia. 2011. - Access mode: http://sv777.ru/images/PDF/sp60.13330.2012.pdf ; 10 4) SP 131.13330.2012. Building climatology. -M.: Ministry of Regional Development of Russia, 2012 - Access mode: http://www.normload.ru/SNiP/raznoe/aktualizir_sp/2/131.htm .
8. Content of the discipline	
The purpose of mastering the discipline "Air conditioning systems" is to develop students' competencies aimed at designing (calculating and choosing) equipment for indoor microclimate systems in buildings for various purposes.	

1. Basic information about the discipline:	
Name of the discipline	Features and prospects for the development of heat and gas supply in the agro-industrial complex
2. Number of credits	7
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	be able to useoperating modes of thermal power equipment, determine the most rational parameters, manage the quality and reliability of the functioning of thermal power systems, and methods to reduce equipment corrosion and environmental technologies. Consider the possibilities of developing the industry, incorporating modern, efficient, environmentally friendly, resource- and energy-saving technologies in heat and power systems.

6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<p>1 Makarov, A. N. Heat transfer in electric arc and flare metallurgical furnaces and power plants. - St. Petersburg. : Lan, 2014. - 384 p.</p> <p>2. Development of innovative technology and equipment for organizing the production of new heat-strengthened materials that are in demand by the country's construction industry. A. T. Kanaev. - Astana: KATU was named after S. Seifullin, 2017. - 91 p.</p> <p>3. Kanaev, A. T. Introduction to nanostructural materials science. - Astana: Master Po, 2018. - 232 p.</p>
8. Content of the discipline	
Formation of new business psychology focused on resource and energy saving, waste disposal and environmental protection among future specialists competent in the field of features and prospects of heat and gas supply in the agro-industrial complex, in the production of agricultural food and livestock breeding, familiarization with the possibilities of improving the efficiency of agro-industrial enterprises complex during the decarbonization of energy systems.	

1. Basic information about the discipline:	
Name of the discipline	Fundamentals of design and construction of pipelines
2. Number of credits	5
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Resource-saving technologies in heat and gas supply and ventilation systems
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<p>1. Varfolomeev Yu.M., Kokorin O.Ya. Heating and heat networks M INFRA-M.: 2006.</p> <p>2. Vilman Yu. A. Technology of construction processes and construction of buildings. Modern progressive methods: textbook. allowance for construction. universities. Moscow: DIA, 2014.</p> <p>3. Taurit V.R., Vasiliev V.F. Ventilation in civil buildings: Proc. allowance SPb.: Publishing house "ANTT-Print". 2008.</p> <p>4. Balashov A.A. Polunina N.Yu. Design of heating and ventilation systems for civil buildings: textbook. - Tam-Bov: Publishing House of FGBOUVPO "TGTU", 2011. - 88 p.</p> <p>5. R. I. Tavastsherna. Manufacturing and installation of technological pipelines / R. I. Tavastsherna - M.: Book on Demand, 2012. - 288 p.</p>
8. Content of the discipline	
As part of the course, the undergraduate will master the theoretical foundations and regulatory documents for the design of modern pipeline systems; will form knowledge, skills and abilities for the design and operation of modern water supply and sanitation systems; acquires the skills of designing and calculating the structural	

elements of modern pipeline systems, and working with design and working documentation, regulatory and reference literature.

1. Basic information about the discipline:	
Name of the discipline	Diagnostics of maintenance of gas pipeline facilities.
2. Number of credits	6
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Gas supply system. Purification and transportation of gases
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1. Porshakov B.P., Lopatin A.S. « Gas compressor units with gas turbine drive on main gas pipelines Methods and means diagnostics of the linear part of the main gas pipelines » M. 2010 2. Ionin A.A., Zhila V.A., Artikhovich V.V., Pshonik M.G. Gas supply: A textbook for universities DIA, 2011. 3. E.A. Shtokman, Yu.N. Karagodin. Heat and gas supply and ventilation: Textbook M.: DIA Publishing House 2011.
8. Content of the discipline	
Study of gas pipeline facilities, organization of operation and repair of gas facilities, methods and means of technical diagnostics as a means of increasing the efficiency and reliability of technology objects in the design and operation process, troubleshooting, as well as means of technical diagnostics and monitoring the technical condition of gas equipment and their design features.	

1. Basic information about the discipline:	
Name of the discipline	Methods for protecting equipment from corrosion
2. Number of credits	5
3. Prerequisites:	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features of modern highly efficient energy-saving heat and power equipment, high-temperature installations, water supply systems, fuel supply, gas supply and transportation, and

	equipment based on renewable energy sources. Possess the skills of installation, commissioning and operation of thermal power equipment, correctly maintain the necessary documentation, as well as use regulatory documents when carrying out these works.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	References: 1. Thermal power plants: a textbook for universities / VD Burov [and others]; ed. V. M. Lavygina, A. S. Sedlova, S. V. Tsaneva. - Moscow: MEI Publishing House, 2007. - 466 p.: ill. - Bibliography: p. 464-465. — ISBN 5-7046-1208-3. 2. Lyubimova, Lyudmila Leonidovna Technology of water treatment for the circuits of boilers, steam generators, reactors and their support systems [Electronic resource]: textbook / L. L. Lyubimova, A. S. Zavorin, A. A. Makeev; National Research Tomsk Polytechnic University (TPU). — 1 computer file (pdf; 761 KB). - Tomsk: TPU Publishing House, 2009. - Title from the title screen. — Electronic version of the printed publication. — Access from the TPU corporate network. — System requirements: Adobe Reader. Litvak, V. F. Panin. - Tomsk: NTL Publishing House, 2009. - 278 p.: ill .. - Bibliography: p. 266-274.. - ISBN 978-5-89503-417-0. Additional literature: 1. Thermal and nuclear power plants: reference book / ed. A. V. Klimenko, V. M. Zorina. - 4th ed., sr .. - Moscow: MEI Publishing House, 2007. - 648 p.: ill .. - Thermal power engineering and heat engineering: reference series: in 4 books; Book. 3. - Bibliography: p. 639. - Subject index: p. 640-644.. - ISBN 978-5-383-00018-2. 2. Improving the environmental safety of thermal power plants: a textbook for universities / A. I. Abramov, D. P. Elizarov, A. N. Remezov et al. - Moscow: MEI Publishing House, 2002. - 378 p.: ill. - Bibliography. at the end of the chapters. - ISBN 5-7046-0712-8. 3. Comprehensive studies of thermal power plants with new technologies: monograph / P. A. Shchinnikov [and others]. - Novosibirsk: Publishing House of NSTU, 2005. - 527 p.: ill .. - Monographs of NSTU. — Bibliography: p. 495-527 (456 titles). - ISBN 5-7782-0516-8.
8. Content of the discipline	<p>The purpose of teaching the discipline is the formation of students' competencies in the design and operation of water supply systems for thermal power plants and nuclear power plants, which determine the energy efficiency, safety and efficiency of power plants.</p> <p>Course content: the course examines the types of water supply systems, issues of organization and operation. Ways to modernize industrial water supply systems in order to increase the efficiency of stations.</p>

1. Basic information about the discipline:	
Name of the discipline	Heat supply in the agro-industrial complex based on renewable energy sources
2. Number of credits	6
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Wind devices for heat and power supply of objects of the agro-industrial sector Wave and tidal power plants
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works.
6. Author of the course	Department of Thermal Power Engineering

7. Basic literature	<p>1. Obozov A.J., Botpaev R.M. " Renewable Energy: A Study Guide ". B.: KSTU, 2010.</p> <p>Kalashnikov N.P. Alternative energy sources. - M.: "Knowledge", 1987.</p> <p>2. Akhmedov R.B. Non-traditional and renewable energy sources. - M.: Society "Knowledge", 1988.</p> <p>3. Vlasov S.I., Tolipov D.A. Non-traditional energy sources. Textbook: Tashkent: University, 2013. - 158 p.</p> <p>4. Frolov A.V. New energy sources: 9th ed. Tula: Publishing House of TulGU, 2017. 219 p.</p> <p>5. Law of the Republic of Kazakhstan dated July 04, 2009 "On supporting the use of renewable energy sources" // Gazette of the Parliament of the Republic of Kazakhstan. - 2009. - No. 13-14. - Art. 61.</p>
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<p>8. Content of the discipline</p> <p>Formation of knowledge about renewable energy sources, the possibilities of their use in solving problems of heat supply and energy saving in the agro-industrial complex. Studying the types of renewable energy sources, prospects and features of use, their role in the overall production of energy; fundamentals of the State energy policy, methods and criteria for evaluating the efficiency of energy use, taking into account economic and environmental requirements in modern conditions.</p>
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1. Basic information about the discipline:	
Name of the discipline	Energy management in heat and gas supply
2. Number of credits	5
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Be able to use the basic provisions and methods of social, humanitarian and economic sciences in solving personal and professional problems, and use communication skills in Kazakh, Russian and foreign languages at a professional level. Possess the skills of implementing energy management at enterprises and the skills in organizing and conducting energy audits.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<p>Basic literature: 1. Strelnikov N. A. Energy saving: textbook - Novosibirsk: NSTU, 2012 - 176 p. - [Electronic resource]. - URL: https://biblioclub.ru/index.php?page=book_red&id=436283&sr=1</p> <p>Additional literature: 2. Grigoryeva, O.K. Energy saving in heat power engineering and heat technologies: study guide / O.K. Grigorieva, A.A. Frantseva, Yu.V. Ovchinnikov. - Novosibirsk: NGTU, 2015. - 258 p.: graph., tab., diagrams., ill. - (Textbooks of NSTU). - Bibliography: p. 235-236. - ISBN 978-5-7782-2606-7; - [Electronic resource]. - URL: https://biblioclub.ru/index.php?page=book&id=436027. 3. G. V. Pankina, T. V. Guseva, F. V. Balashov, Yu. - [Electronic resource]. - URL: https://biblioclub.ru/index.php?page=book_red&id=137024&sr=1 4. Sibikin M. Yu., Sibikin Yu. D. Energy saving technology: textbook - M., Berlin: DirectMedia, 2014 - 352 With. - [Electronic resource]. - URL: https://biblioclub.ru/index.php?page=book_red&id=253968&sr=1</p>
<p>8. Content of the discipline</p> <p>Studying the strategy and methods for implementing energy management in heat supply organizations, and methods for conducting an energy audit of heat supply systems for industrial heat power and housing and communal services will allow students to solve practical problems related to obtaining qualitative and quantitative assessments of the state of energy systems, identify the causes of unreasonable energy losses, and develop energy-saving measures. Proficiency in analyzing the actual state of energy use in enterprises.</p>	

1. Basic information about the discipline:	
Name of the discipline	Structural materials in TGV
2. Number of credits	5
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	Basic literature 1. Ilyaschenko D.P. Properties and structure of metals and alloys used in mechanical engineering: Textbook. - Yurga: Publishing House of Yuti TPU, 2006. - 48 p. 2. The technology of processing structural materials: Textbook for universities / S.D. Kugultinov, A.K. Kovalchuk, I.I. Portnov. - 2nd ed., stereotype. - M.: Publishing house of MSTU n. N.E. Bauman, 2008. - 672 p. 3. Grader of steels and alloys. Kazakov S.I., Nikitin V.M. Department "Technology and Automation of Welding Production" KSU 2008. Auxiliary literature 1. Metal science and technology of metals: Proc. for universities. Yu.P. Solntsev, V.A. Veselov, V.P. Demyantsevich and others - M.: Metallurgy, 1988. - 512 p. 2. The technology of metals and materials science. / Ed. L.F. Usova. - M.: Metallurgy, 1987. - 800 p. 3. Ilyashchenko D.P. Laboratory workshop on the discipline "Technology of structural materials": textbook / D.P. Ilyashchenko, E.A. Zernin, S.A. Chernova: Yurga Technological Institute. - Tomsk: Publishing House of Tomsk Polytechnic University, 2012. - 178 p.
8. Content of the discipline	Formation of knowledge about modern materials used in heat supply, gas supply and ventilation, as well as the technology of their application. Familiarization with the technology of welding, technological features of the production of structural materials, and heat treatment of materials, including metals.

1. Basic information about the discipline:	
Name of the discipline	Designs of furnace and burner devices for heat supply to buildings and structures of various
2. Number of credits	5
3. Prerequisites:	Undergraduate disciplines
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment,

	determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	Basic literature 1. Ilyaschenko D.P. Properties and structure of metals and alloys used in mechanical engineering: Textbook. - Yurga: Publishing House of Yuti TPU, 2006. - 48 p. 2. The technology of processing structural materials: Textbook for universities / S.D. Kugultinov, A.K. Kovalchuk, I.I. Portnov. - 2nd ed., stereotype. - M.: Publishing house of MSTU n. N.E. Bauman, 2008. - 672 p. 3. Grader of steels and alloys. Kazakov S.I., Nikitin V.M. Department "Technology and Automation of Welding Production" KSU 2008. Auxiliary literature 1. Metal science and technology of metals: Proc. for universities. Yu.P. Solntsev, V.A. Veselov, V.P. Demyantsevich and others - M.: Metallurgy, 1988. - 512 p. 2. The technology of metals and materials science. / Ed. L.F. Usova. - M.: Metallurgy, 1987. - 800 p. 3. Ilyashchenko D.P. Laboratory workshop on the discipline "Technology of structural materials": textbook / D.P. Ilyashchenko, E.A. Zernin, S.A. Chernova: Yurga Technological Institute. - Tomsk: Publishing House of Tomsk Polytechnic University, 2012. - 178 p.
8. Content of the discipline	Training of a specialist in the field of fuel combustion methods in boiler furnaces intended for heat supply of buildings and structures. Acquaintance with modern methods of burning gaseous, liquid and solid fuels with the highest efficiency, with the methodology for calculating burners depending on the type and characteristics of the fuel being burned.
1. Basic information about the discipline: Gas turbine installations for the transportation of oil and gas	
2. Number of credits	5
3. Prerequisites:	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features of modern highly efficient energy-saving heat and power equipment, high-temperature installations, water supply systems, fuel supply, gas supply and transportation, and equipment based on renewable energy sources. Possess the skills of installation, commissioning and operation of thermal power equipment, correctly maintain the necessary documentation, as well as use regulatory documents when carrying out these works.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	1 Kadyrbaev A.K. Engineering networks and equipment. - Almaty: Bastau, 2013. - 288 p. 2. Feofanov, Yu. A. Engineering networks: modern pipes and products for repair and construction. - M.: Yurayt, 2020. - 157 p. 3. Kanaev, A. T. Introduction to nanostructural materials science. - Astana: Master Po, 2018. - 232 p.
8. Content of the discipline	Formation of basic knowledge of gas turbine maintenance technologies in accordance with the requirements of regulatory and technical documentation. Skills developplanning and organizing maintenance, working on scheduled preventive repairs of gas turbines, organizing technical condition checks and industrial safety

reviews, and assessing and operating reliability of gas turbine units.	
1. Basic information about the discipline:	
Name of the discipline	Physical and chemical modelling of heat engineering processes
2. Number of credits	5
3. Prerequisites:	Mathematics, Theoretical foundations of heat engineering, Physics, Chemistry.
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know computer technologies and programs for thermal calculations and processing of research results, and apply methods of mathematical analysis and modelling. Own methods of scientific research, engineering experiment, data analysis and processing, application software, modern methods of searching for scientific information on the topic of scientific research, and academic writing. Understand the implications of the principles and culture of academic integrity. Be able to identify scientific and technical problems of thermal power engineering, and offer solutions.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1 Baklanova O.E. Modeling in physics: A course of lectures for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2010. - 107 p. 2 Baklanova O.E. Modeling in physics: Guidelines for practical exercises for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 113 p. 3 Baklanova O.E. Modeling in physics: Guidelines for SIWT and SIW for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 78 p. 4 Baklanova O.E., Kvasov A.I., Khakimzyanov G.S., Shvets O.Ya. Fundamentals of Mathematical Modeling: Textbook. - Ust-Kamenogorsk: EKSTU, 2013. - 126 p. 5 Belov P.N. Numerical methods of weather forecasting.-L.: Gidrometeoizdat, 1975. -392s., 6 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. L: Gidrometeoizdat, 1989. 7 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. - L .: Gidrometeoizdat, 1989 8 Weinberg M. Mathematical modelling of transport processes. Solution of nonlinear boundary value problems. 2009 9 Volodin E.M. Mathematical modelling of the general circulation of the atmosphere. Lecture course. Institute of Computational Mathematics RAS, 2007
8. The content of the discipline.	
The main goal of education in the discipline is to develop the ability of students to apply the basic laws of natural sciences, and methods of physical and chemical modelling for making design decisions in their professional activities, in order to model processes, devices, systems and methods in the field of thermal power engineering.	
1. Basic information about the discipline:	
Name of the discipline	Energy efficient ventilation and air conditioning systems
2. Number of credits	5
3. Prerequisites:	Mathematics, Theoretical foundations of heat engineering, Physics, Chemistry.
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features and materials of modern highly

	<p>efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems.</p>
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1 Baklanova O.E. Modeling in physics: A course of lectures for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2010. - 107 p. 2 Baklanova O.E. Modeling in physics: Guidelines for practical exercises for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 113 p. 3 Baklanova O.E. Modeling in physics: Guidelines for SIWT and SIW for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 78 p. 4 Baklanova O.E., Kvasov A.I., Khakimzyanov G.S., Shvets O.Ya. Fundamentals of Mathematical Modeling: Textbook. - Ust-Kamenogorsk: EKSTU, 2013. - 126 p. 5 Belov P.N. Numerical methods of weather forecasting.-L.: Gidrometeoizdat, 1975. -392s., 6 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. L: Gidrometeoizdat, 1989. 7 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. - L .: Gidrometeoizdat, 1989 8 Weinberg M. Mathematical modelling of transport processes. Solution of nonlinear boundary value problems. 2009 9 Volodin E.M. Mathematical modelling of the general circulation of the atmosphere. Lecture course. Institute of Computational Mathematics RAS, 2007
8. The content of the discipline.	<p>Development of students' competencies aimed at designing efficient ventilation and air conditioning systems for buildings with minimal heat energy consumption for their operation. The study of the properties of air and the processes of changing its state, the thermal regime of the room, the determination of the air exchange of ventilation and air conditioning systems, schematic diagrams and design solutions for system equipment.</p>
1. Basic information about the discipline: Engineering experiment	
2. Number of credits	four
3. Prerequisites:	Fundamentals of Scientific Research
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	be able to use operating modes of thermal power equipment, determine the most rational parameters, manage the quality and reliability of the functioning of thermal power systems, and methods to reduce equipment corrosion and environmental technologies. Consider the

	possibilities of developing the industry, incorporating modern, efficient, environmentally friendly, resource- and energy-saving technologies in heat and power systems.
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1. Kanaev A. T. Fundamentals of the methodology of scientific creativity and innovation. - Astana: KazATU named after S. Seifullin, 2016. - 185 p. 2. Fundamentals of innovative development of science and education. - Penza: Science and education, 2017. - 188 p. 3. Alinov M. Sh . Innovation management. - Almaty: Bastau, 2012. - 204 p.
8. Content of the discipline	
Familiarization with the theoretical provisions of the theory of planning experimental research; formation of skills: in organizing and planning scientific work, conducting a scientific experiment and processing its results; using (led) modelling techniques; data collection, analysis of scientific and technical information on the subject of the study; development of technical documentation, basic regulatory documents on intellectual property issues, preparation of documents for patenting	
1. Basic information about the discipline:	
Name of the discipline	Approximate methods for solving heat engineering problems
2. Number of credits	5
3. Prerequisites:	Mathematics, Theoretical foundations of heat engineering, Physics, Chemistry.
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	<p>Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems. Own methods of scientific research, engineering experiment, data analysis and processing, application software, modern methods of searching for scientific information on the topic of scientific research, and academic writing. Understand the implications of the principles and culture of academic integrity. Be able to identify scientific and technical problems of thermal power engineering, and offer solutions.</p>
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1 Baklanova O.E. Modeling in physics: A course of lectures for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2010. - 107 p. 2 Baklanova O.E. Modeling in physics: Guidelines for practical exercises for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 113 p.

	<p>3 Baklanova O.E. Modeling in physics: Guidelines for SIWT and SIW for undergraduates of the speciality 6M070500 "Mathematical and computer modelling". - Ust-Kamenogorsk: EKSTU, 2013. - 78 p.</p> <p>4 Baklanova O.E., Kvasov A.I., Khakimzyanov G.S., Shvets O.Ya. Fundamentals of Mathematical Modeling: Textbook. - Ust-Kamenogorsk: EKSTU, 2013. - 126 p.</p> <p>5 Belov P.N. Numerical methods of weather forecasting.-L.: Gidrometeoizdat, 1975. -392s.,</p> <p>6 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. L: Gidrometeoizdat, 1989.</p> <p>7 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. - L .: Gidrometeoizdat, 1989</p> <p>8 Weinberg M. Mathematical modelling of transport processes. Solution of nonlinear boundary value problems. 2009</p> <p>9 Volodin E.M. Mathematical modelling of the general circulation of the atmosphere. Lecture course. Institute of Computational Mathematics RAS, 2007</p>
<p>8. The content of the discipline. Formation of in-depth knowledge of undergraduates' knowledge of methods for solving heat engineering problems, the use of computer technology, methods for modelling and optimizing heat and power and heat engineering processes, installations and systems. O possession of methods and techniques of analogue, physical and mathematical modelling of processes, devices and systems of heat power engineering and heat technology, the skills of conducting a computational experiment a.</p>	
<p>1. Basic information about the discipline:</p>	
<p>Name of the discipline</p>	<p>Calculations of heat transfer in enclosing structures</p>
<p>2. Number of credits</p>	<p>four</p>
<p>3. Prerequisites:</p>	<p>Maths. Physics. Applied mechanics of liquid and gas. Theoretical foundations of heat engineering. Heat and mass transfer.</p>
<p>4. Postrequisites:</p>	<p>Disciplines of doctoral studies</p>
<p>5. Competencies:</p>	<p>Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems.</p>
<p>6. Author of the course</p>	<p>Department of Thermal Power Engineering</p>
<p>7. Basic literature</p>	<p>1 SNIp II-3-79* Construction heat engineering. - M.: Ministry of Construction of Russia, 1995.-29s. 2 SNIp 2.01.01-82 Construction climatology and geophysics. -M.: Stroyizdat, 1983.-56s. 3 SNIp 2.08.01-90 Residential buildings. -M.: Gosstroy of the USSR, 1990. - 35s. 4 Maklakova T.G. Constructions of civil buildings: Textbook for</p>

	universities / T.G. Maklakova, S.M. Nanasova. - M.: Izd-vo ASV, 2002. - 272p. 5 Maklakova T.G. Design of residential and public buildings: Textbook for universities. - M.: VSh, 1998.- 400s.
8. Content of the discipline	
The purpose of mastering the discipline is: to obtain in-depth information about the current level of knowledge in the field of heat and mass transfer in building envelopes, the theory of the state and moisture transfer in building materials, about patterns of moistening of building envelopes, about the main directions of energy saving when improving building envelopes due to the possible full taking into account the physical factors acting in the enclosing structures.	
1. Basic information about the discipline:	
Name of the discipline	Obtaining secondary fuel during waste processing
2. Number of credits	5
3. Prerequisites:	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	<p>Know the design features of modern highly efficient energy-saving heat and power equipment, high-temperature installations, water supply systems, fuel supply, gas supply and transportation, and equipment based on renewable energy sources. Possess the skills of installation, commissioning and operation of thermal power equipment, correctly maintain the necessary documentation, as well as use regulatory documents when carrying out these works.</p> <p>be able to use operating modes of thermal power equipment, determine the most rational parameters, manage the quality and reliability of the functioning of thermal power systems, and methods to reduce equipment corrosion and environmental technologies. Consider the possibilities of developing the industry, incorporating modern, efficient, environmentally friendly, resource- and energy-saving technologies in heat and power systems.</p>
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<p>1. Batluk V.A. Environmental protection at thermal power plants. Lvov: Afisha, 2012. 477p.</p> <p>2. Voronkov N.A. Ecology general, social, applied: Textbook for students of higher educational institutions. A guide for teachers. M.: Agar, 1999. 97p. 3. Demina T.A. Ecology, nature management, environmental protection. M.: Nauka, 1999. 87p. 4. Zalkind I.Ya., Vdovichenko V.S. Ash and slag in boiler furnaces. M.: Stroyizdat, 1974. 93s. 5. Kitaev I.V. Ash-forming and minor elements of the coals of the Far East. Vladivostok, 1989. 136 p. 6. Kogan R.M. Anthropogenic pollutants of the territory of the Jewish Autonomous Region. Vladivostok.: Dalnaua, 2001. 166s. 7. Recommendation on the use of ash, slag and ash and slag mixtures in thermal power plants in concrete. NIIZhB. Moscow: Stroyizdat, 1986.80s.</p>
8. Content of the discipline	
Formation of knowledge about the methods of handling industrial, household waste, secondary raw materials and fuel resources. Acquaintance with the technological reasons for the formation of waste and harmful emissions. Mastery of skills: development of proposals for the introduction of new equipment and technologies and their technological and economic justification; calculation and analysis of resource and energy saving as a result of their implementation.	
1. Basic information about the discipline:	
Name of the discipline	Ways of development of low-power boilers
2. Number of credits	5

3. Prerequisites:	Maths. Physics. Applied mechanics of liquid and gas. Theoretical foundations of heat engineering. Undergraduate disciplines
4. Postrequisites:	Disciplines of doctoral studies
5. Competencies:	Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems. Own methods of scientific research, engineering experiment, data analysis and processing, application software, modern methods of searching for scientific information on the topic of scientific research, and academic writing. Understand the implications of the principles and culture of academic integrity. Be able to identify scientific and technical problems of thermal power engineering, offer solutions
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	1. Dneprov, Yu. V. Installation of boiler plants. small and middle power. M: Higher school, 1980. - 334 p. 2. Sokolov, B. A. Device and operation of steam and hot water boilers small and middle power M. : Publishing Center "Academy", 2008. - 64 p. 3. Batluk V.A. Environmental protection at thermal power plants. Lvov: Afisha, 2012. 477p.
8. Content of the discipline	The study of the principles of operation of the designs of modern low-power boilers, and the processes occurring in them, are promising areas for the development of small-scale boiler building. Acquisition of skills: performance of heat engineering, hydraulic and aerodynamic calculations of low power boiler units; operation of low power boiler units, the performance of adjustment and research work; development and optimization of technological schemes for the production of thermal energy.
1. Basic information about the discipline:	
Name of the discipline	Limit Energy Saving Methods
2. Number of credits	5
3. Author of the course	Department of Thermal Power Engineering
4. Basic literature	1. Combustion chambers and gas turbine burners installations. - Astana: KATU named after S. Seifullin, 2017. - 205 p. 2. Makarov A. N. Heat transfer in electric arc and torch metallurgical furnaces and power plants. - St. Petersburg. : Lan, 2014. - 384 p. 3. Borovkov, V. M. Heat engineering equipment. - M. : Publishing centre "Academy", 2015. - 192 p.

5. Competencies:	<p>Know the design features and materials of modern highly efficient equipment for the production and transportation of thermal energy, equipment for main gas pipelines and distribution points, water supply and fuel supply systems, and equipment based on renewable energy sources. Possess the skills of designing, installing, commissioning and operating equipment for heating networks and gas pipelines, maintaining the necessary documentation, as well as using regulatory documents when carrying out these works. Be able to analyze the modes of operation of thermal power equipment, determine the most rational parameters and energy-saving modes of operation, and manage the quality and reliability of the functioning of heat supply, ventilation and gas supply systems. Own methods of reducing corrosion of equipment and environmental technologies. Consider the possibilities of developing the industry, and introducing modern, efficient, environmentally friendly, resource- and energy-saving technologies into heat and gas supply systems.</p>
6. Author of the course	Department of Thermal Power Engineering
7. Basic literature	<ol style="list-style-type: none"> 1. Dikhanbaev B.I., Intensive resource and energy saving in the processing of mineral raw materials, textbook, 2018 2. Fundamentals of energy saving and energy efficiency: textbook. allowance / M. Sh. Alinov; Ministry of Education and Science Rep. Kazakhstan. - Almaty: Bastau, 2015. - 288 p. 3. Energy fuels: abrasiveness and wear [Text]: textbook / A. M. Dostiyarov, G. A. Akimbek, B. T. Bakhtiyar; Ministry of Education and Science of the Republic of Kazakhstan, non-profit joint-stock company "Almaty University of Energy and Communications". - Almaty: AEzhBU, 2020. - 218 p.
8. Content discipline Formation of undergraduates' competencies in the field of modern approaches to energy saving and energy management, in which the issues of energy resource management and efficiency improvement are considered not only from a technical point of view but also taking into account organizational, economic, motivational, and informational aspects. Methods for organizing the optimal functioning and development of the energy supply part of organizations are considered; principles of energy resource management and energy efficiency.	