

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**  
**7M07101 Thermal engineering**

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

**7M07101 Thermal engineering**

Training period: 2 years

Astana 2022

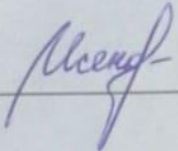
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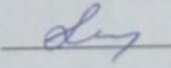
JSC named after S. Seifullin "KATU" No. 932 dated 12.12.2018, the author's team was approved by the order.

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.

## Content

No.	Component name	Page
1	Passport of the educational program	four
2.	General characteristics of the educational program	four
3.	Competence model ( portrait) of a graduate	5
4	The base of professional practice	9
5.	The structure of the educational program	eleven
6.	Annexe 1. Academic Calendar	12
7.	Annexe 2. Working Curriculum	13
8	Annexe 3. Description of the disciplines of the compulsory and university components	fourteen
9.	Annexe 4. Description of the disciplines of the component of choice	16

## **1.Passport of the educational program**

### **1.1 Purpose of the educational program**

**The main goal** of the educational program is the formation of the graduate's personal qualities, as well as general cultural and professional competencies that allow them to carry out professional activities related to a set of technologies, tools, methods and methods of human activity created to generate and use heat, control its flows and convert various types of energy into warmth.

The main objectives of the educational master's program "**Thermal Engineering**":

- to provide an individual educational trajectory of training in accordance with 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 has a civil position, are able to 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 prepare, based on the consolidation of the scientific and educational resources of the university, competitive specialists in the field of thermal power engineering, 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**

At present, the rapid development of industry and energy dictates its requirements, and the general renewal of technological installations dictates their careful operation. Efficient use of energy is a continuous and constant necessity. Because in Kazakhstan 85% of electricity is generated by coal-fired thermal power plants, the need for training under this OP will be constantly high. The uniqueness of the educational program lies in the fact that this activity is associated with high risks due to the operation of equipment with high parameters of the working environment (temperature, pressure) and large structures. In addition, today it is difficult to imagine life without heat, electricity and hot water. In this regard, the purpose of the educational program is to create a future competent specialist in heat and power and heat engineering.

The modular educational program is developed by the National Qualifications Framework and is 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 " **Thermal Engineering** " provides 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 in accordance with the State Educational Standard of the Republic of Kazakhstan in the direction of **Thermal Engineering**, 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 credits, 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 is thermal power engineering as an integral part of technology, which includes a set of means, methods and methods of human activity created to generate and use heat, control its flows and convert various types of energy into heat.

**The subjects** of professional activity of masters in the educational program **7M 071700 - Thermal engineering** are:

- thermal power plants;
- industrial and heating boiler rooms ;
- technology heats ;
- centralized and autonomous power supply of industrial enterprises and organizations;
- production and distribution of energy carriers;
- heating and heating networks;
- preparation of water and fuel;
- automated control of heat power and heat technology facilities;
- as well as methods and tools for modelling and optimizing objects of thermal power engineering and thermal technology;
- main and auxiliary equipment, processes and devices of heat technology.

**Objects** professional activities of the graduate are:

- energy systems and complexes;
- systems of power supply of objects of equipment and branches of economy;
- systems of power supply of industrial enterprises;

- power supply systems for autonomous objects;
- power plants;
- power plants and complexes based on non-traditional and renewable energy sources;
- heat-technological production schemes;
- technological installations for the production, distribution and use of heat;
- steam and hot water boilers for various purposes, steam generators of nuclear power plants;
- steam and gas turbines, power units;
- installations for the production of compressed and liquefied gases, compressors, refrigeration and cryogenic installations, installations of air conditioning systems, and heat pumps;
- installations, systems and complexes of high-temperature and thermal-moisture technologies, chemical reactors;
- auxiliary heat engineering equipment, heat and mass transfer apparatus for various purposes;
- heating network;
- installations for conditioning heat carriers and working fluids;
- technological liquids, gases and vapours;
- melts, solid and loses bodies as heat carriers and working bodies of power and technological installations;
- fuel and oils;
- fuel and oil preparation systems;
- installations, systems and complexes for the preparation and use of water of normalized quality;
- technological installations for the preparation and use of water from thermal and nuclear power plants: equipment for pre-treatment, ion exchanger and membrane installations, technological installations for the preparation and use of water from heating networks and consumers of heating;
- water recycling systems;
- Installations, systems and complexes for wastewater treatment;
- installations, systems and complexes for the preparation and use of water in the food industry;
- technological equipment for the preparation and use of water in evaporative and steam-converting plants;
- systems of automatic control and management of heat and electro-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 clearly 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 own 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; owns 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 one of 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;

### **3.4 Core competencies:**

- conducting scientific research and development in the field of thermal power engineering and thermal technology, energy use and energy supply in separate sections (stages, tasks) of the topic in accordance with 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 and power and heat engineering equipment;
- conducting a technical justification of the decisions made on the development of heat power and heat technology systems;
- development of mathematical and simulation models for the functioning of heat power and heat technology installations and systems;
- analysis of the state and prospects for the development of thermal power engineering, power engineering, and thermal technology, using the necessary tools and methods;

- 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 heat-technological equipment, installations and complexes;
- use of modelling and optimization methods for heat engineering processes, installations and systems;
- implementation of fundamentally new non-waste processes and complexes;
- establishing the potential and reserves of energy saving in the industries of production;
- development of new promising and non-traditional methods for processing technological and natural waters and fuel preparation;
- research and implementation of low-waste and waste-free technologies;
- the study of physical and chemical processes of water and fuel preparation with the wide use of modelling and computer technologies;
- the 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;
- **organizational and managerial activities:**
  - 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 heat engineering equipment;
  - organization of accounting and rationing of fuel-energy resources costs;
  - 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 process equipment;
- 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) in accordance with the order of the rector on the practice. From KATU n. S.Seifullina is assigned practice leaders for each doctoral student.

Undergraduates undergo practical training and internships 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 ( WarsawUniversityofTechnology ),
- Moscow Power Engineering Institute (Technical University),

as well as, in the boiler room of the university and at the department, where there is a specialized research laboratory on energy problems. On the basis of 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 heat and power and heat engineering equipment.

Bases for passing industrial practices: JSC "Astana Energy", JSC "Astana Teplotranzit", GKP on REM "Kyzylordateploelektrotsentr", GKP on REM " Ozen Zhylu ", Ozen, Semey " GKP Teplokommunenergo ", Aktau, GKP " Caspian Zhylu, Su Arnasy.

## 5 The structure of the educational program of the master's program in the scientific and pedagogical direction of " Thermal Engineering "

No. p / p	Name of cycles of disciplines and activities	General labour intensity	
		in academic hours	in academic credits
1	2	3	4
1.	<b>Theoretical training</b>	<b>2520</b>	<b>84</b>
1.1	<b>The cycle of basic disciplines (DB)</b>	<b>1050</b>	<b>35</b>
1)	<b>University component (VC):</b>	<b>600</b>	
20	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)	<b>Component of choice (CV)</b>	<b>450</b>	<b>fifteen</b>
	Methods for protecting equipment from corrosion	150	5
	Technical water supply systems		
	High-Temperature Processes and Plants	150	5
	Physical and chemical modelling of heat engineering processes		
	Gas turbine units for oil and gas transportation	150	5
	Features and prospects for the development of heat and gas supply in the agro-industrial complex		
1.2	<b>The cycle of major disciplines (PD)</b>	<b>1470</b>	<b>49</b>
1)	<b>University component (VC)</b>	<b>900</b>	
30	Cycles and installations of thermal processes	180	6
	Scientific and technical problems of heat power engineering and heat technology	150	5
	Limit Energy Saving Methods	150	5
	engineering experiment	120	four
	Heat supply based on renewable energy sources	150	5
	Research practice	150	5
2)	<b>Component of choice (CV)</b>	<b>570</b>	<b>19</b>
	Ways of development of low-power boilers	120	four
	Designs of furnace and burner devices for heat supply to buildings and structures		
	Approximate methods for solving heat engineering problems	150	5
	Technological methods for reducing the formation of harmful emissions at thermal power plants		
	Energy efficient building envelopes	150	5
	Calculations of heat transfer in enclosing structures		
	Waste generation in subdivisions and workshops of a thermal power plant	150	5
	Obtaining secondary fuel during waste processing		
2	<b>Research work</b>	<b>720</b>	<b>24</b>

one)	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	<b>Final certification (FA)</b>	<b>360</b>	<b>12</b>
one)	Registration and defence of a master's thesis (OiZMD)	360	12
	<b>Total</b>	<b>3600</b>	<b>120</b>

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

<b>1. Basic information about the discipline:</b>	
Name of the discipline	History and philosophy of science
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Philosophy
<b>4. Postrequisites:</b>	Philosophical problems of technology
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Philosophy
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Ts.R.Zaychik, B.Ts.Zaychik. History and philosophy of science and technology. M: Academic project. 2010 - 275s. (24 copies)</li> <li>2. Stepin V.S. History and philosophy of science. M: Higher school. 2012 - 275s. (12 copies)</li> <li>3. Shtanko V.I. Philosophy and methodology of science. Kharkiv. Phoenix Publishing. 2002 - 345s. (16 copies).</li> </ol>
<b>8. Content of the discipline</b>	
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.	

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Foreign language (professional)
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Foreign language (bachelor's degree) (B1-B2) English for special purposes (B1-B2) Vocational-oriented foreign language (B1-B2)
<b>4. Postrequisites:</b>	Disciplines in the speciality in English, English for Academic Purposes
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Foreign Languages
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Laurence Anthony (May 18, 2018) Introducing English for Specific Purposes (Routledge Introductions to English for Specific Purposes) 1st Edition. Routledge</li> <li>2. John Flowerdew, Tracey Costley (07 Oct</li> </ol>

	2016). Discipline-Specific Writing: Theory into practice. Taylor & Francis Ltd. 3. by Jackie Stavros, Cheri Torres, David L. Cooperrider (May 22, 2018). Conversations Worth Having: Using Appreciative Inquiry to Fuel Productive and Meaningful Engagement. Berrett-Koehler Publishers 4. Nadežda Stojković (July 2018) Positioning English for Specific Purposes in an English Language Teaching Context. Vernon Series in Education.
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### 8. Content of the discipline

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.

<b>1. Basic information about the discipline:</b>	
Name of the discipline	<b>Pedagogy of higher education</b>
<b>2. Number of credits</b>	<b>3</b>
<b>3. Prerequisites:</b>	Political science and sociology
<b>4. Postrequisites:</b>	Psychology
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Pedagogy
<b>7. Basic literature</b>	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
<b>8. Content of the discipline</b>	
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.	

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

<b>4. Postrequisites:</b>	
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Pedagogy
<b>7. Basic literature</b>	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.
<b>8. Content of the discipline</b>	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**

<b>1. Basic information about the discipline:</b>	
Name of the discipline	<b>Scientific and technical problems in heat power engineering and heat technology</b>
<b>2. Number of credits</b>	<b>6</b>
<b>3. Prerequisites:</b>	Undergraduate disciplines
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	Know and understand: the stages and sequence of scientific development of the thermal power complex and thermal technology objects, Be able to: predict and look for ways to solve the problems of the heat and power complex, See prospects for the development of used domestic and foreign modern thermal power plants and systems.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	Main literature: 1. Yashura A.I. System of maintenance and repair of power plants. M: Energoatomizdat. 2003 - 332p. 2. Technology of combustion of organic fuels. Energy fuels. Grigoriev K.A. 2006 Additional literature: 3. Kolpachkov V.I., Yashchura A.I. Production operation, maintenance and repair of power equipment. M: Energoatomizdat. 2001 - 179s.

<b>8. Content of the discipline</b>	

Within this discipline, the following are considered: research methods, rules and conditions for performing innovative work, conducting scientific research and calculations, and determining the technical and economic efficiency of ongoing research in accordance with the achievements of science and technology, in the field of world thermal power engineering and thermal power engineering of Kazakhstan.

<b>1. Basic information about the discipline:</b>	
Name of the discipline	<b>Cycles and installations of thermal processes</b>
<b>2. Number of credits</b>	<b>6</b>
<b>3. Prerequisites:</b>	Maths. Physics. Applied mechanics of liquid and gas. Theoretical foundations of heat engineering. Undergraduate disciplines
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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. 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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	Main literature: 1. Heat engineering. Lukanin V.N. 2000 2. Fundamentals of heat engineering. Boyko E.A. 2004 additional literature 1. Calculation of the methodical furnace. Tarasenko M.O. 2004
<b>8. Content of the discipline</b>	
The program, in accordance with the requirements for a student in this area, provides for the study of the basic laws of thermodynamics, i.e. patterns of energy conversion of various types, accompanied by thermal phenomena; cycles of internal combustion engines and gas turbines, the design of internal combustion engines, gas turbines and the basis for their calculation; devices of refrigeration units and air conditioning systems; heat transfer, which is the doctrine of the processes of heat propagation in space with a non-uniform temperature field; design and basic calculation of heat exchangers.	

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Calculations of heat transfer in enclosing structures
<b>2. Number of credits</b>	<b>6</b>
<b>3. Prerequisites:</b>	Maths. Physics. Applied mechanics of liquid and gas. Theoretical foundations of heat engineering. Heat and mass transfer.
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	As a result of mastering the discipline, the student must: <b>Know:</b> - the principles of calculation and regulation of the heat-shielding properties of the building shell structures; the influence of moisture content of materials on the heat-shielding properties of enclosing structures; thermophysical characteristics of building materials, methods for their experimental determination and calculation; fundamental technical solutions of modern enclosing structures with



	<p>enhanced heat-shielding properties. principles for determining the transmission heat loss of a building.</p> <p><b>Be able to:</b> determine the calculated values of the thermophysical characteristics of building materials; determine the values of the reduced resistances of enclosing structures; determine zones of maximum moisture in building envelopes; - determine the required values of resistance to vapour permeability of enclosing structures.</p> <p><b>Own:</b> methods for calculating the reduced resistance of enclosing structures; methods of working with the joint venture "Calculation of the reduced resistance to heat transfer of enclosing structures"; methods for calculating the porous structure of building materials; methods for predicting the moisture state of building envelopes; methods for assessing the impact of moisture content of building envelope materials on energy consumption for heating a building.</p>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	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 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.
<b>8. Content of the discipline</b>	<p>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.</p>

<b>1. Basic information about the discipline:</b>	
Name of the discipline	<b>Limit Energy Saving Methods</b>
<b>2. Number of credits</b>	<b>5</b>
<b>3. Author of the course</b>	Department of Thermal Power Engineering
<b>4. Basic literature</b>	<p>1. Combustion chambers and gas turbine burners installations. - Astana: KATU was named after S. Seifullin, 2017. - 205 p.</p> <p>2.Makarov A. N. Heat transfer in electric arc and torch metallurgical furnaces and power plants. - St. Petersburg. : Lan, 2014. - 384 p.</p> <p>3. Borovkov, V. M. Heat engineering equipment. - M.: Publishing centre "Academy", 2015. - 192 p.</p>
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering

<b>7. Basic literature</b>	<p>1. Dikhanbaev B.I., Intensive resource and energy saving in the processing of mineral raw materials, textbook, 2018</p> <p>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.</p> <p>3. Energy standard: abrasive pentose [Text]: okulyk / A. M. Dostiyarov, G. A. Akimbek, B. T. Bakhtiyar; Kazakhstan Republics Bilim Zhane Gylym Minister of League, "Almaty Power Engineering Baylanys University" Commercial Emes Shareholder of Kogama. - Almaty: AEzhBU, 2020. - 218 b.</p>
<b>8. Content of the discipline</b> 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.	

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Waste generation in thermal power plants and boiler houses
<b>2. Number of credits</b>	<b>6</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<p>1. Batluk V.A. Fundamentals of ecology and environmental protection. Tutorial. Lvov: Afisha, 2012. 147p.</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.</p> <p>3. Demina T.A. Ecology, nature management, environmental protection. M.: Nauka, 1999. 87p.</p> <p>4. Zalkind I.Ya., Vdovichenko V.S. Ash and slag in boiler furnaces. M.: Stroyizdat, 1974. 93s.</p> <p>5. Kitaev I.V. Ash-forming and minor elements of the coals</p>

	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.
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### 8. Content of the discipline

Familiarization of students with: the processes of generation of TPP waste; types of waste entering the environment, their physical and chemical characteristics; indicators of their energy and environmental impact; technologies for capturing particulate matter from flue gases; the methodology of system-structural analysis, which considers trends and alternatives for the development of non-waste energy production and all processes of interaction between TPPs and the environment.

### 1. Basic information about the discipline:

Name of the discipline	Waste generation in thermal power plants and boiler houses
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. Fundamentals of ecology and environmental protection. Tutorial. Lvov: Afisha, 2012. 147p.</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.</p> <p>3. Demina T.A. Ecology, nature management, environmental protection. M.: Nauka, 1999. 87p.</p> <p>4. Zalkind I.Ya., Vdovichenko V.S. Ash and slag in boiler furnaces. M.: Stroyizdat, 1974. 93s.</p> <p>5. Kitaev I.V. Ash-forming and minor elements of the coals of the Far East. Vladivostok, 1989. 136 p.</p> <p>6. Kogan R.M. Anthropogenic pollutants of the territory of the Jewish Autonomous Region. Vladivostok.: Dalnaua, 2001. 166s.</p> <p>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.

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Methods for protecting equipment from corrosion
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	1 A.I. Glazyrin, A.A. Glazyrin, R.K. Orumbaev. Corrosion and conservation of heat power equipment. - Pavlodar: ECO, 2011.-728 p. 2 I.V. Semenov. Corrosion and corrosion protection: a textbook for universities in the direction of "Chemical technology of inorganic substances and materials". - 3rd ed. revised and additional .. - M.: Fizmatlit, 2010. - 414 p. 3 Neverov, A. S., Rodchenko, D. A., Tsyrlin, M. I. Corrosion and protection of materials: textbook. allowance for students. universities. - Minsk: Higher School, 2007. - 222 p. 4. Sivenkov, A.V. Corrosion and corrosion resistant coatings : educational and methodical complex/comp. A.V. Sivenkov. - St. Petersburg: Izdvo SZTU, 2009.142 p. 5. Solntsev, Yu.P. Materials science of special branches of mechanical engineering: textbook. allowance for universities / Yu.P. Solntsev, V.Yu. Pirainen, S.A. Vologzhanina; ed. Yu.P. Solntseva. St. Petersburg: Himizdat, 2007. 782 p.
<b>8. Content of the discipline</b>	Knowledge is being formed about: the mechanisms of corrosion, its impact on the engineering infrastructure of cities; methods and means of reducing and preventing corrosion; application of modern materials, equipment, devices, and technologies; improving the operation of protection systems. Skills are being developed: determining the characteristics and parameters of corrosion processes; calculation of corrosion protection systems; the use of basic means of protecting engineering systems and equipment from corrosion.

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Technical water supply systems of thermal power plants
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, Theoretical foundations of thermal power plants, Physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	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.
<b>8. Content of the discipline</b>	<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>

<b>1. Basic information about the discipline:</b>	
Name of the discipline	Physical and chemical modelling of heat engineering processes
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Mathematics, Theoretical foundations of heat engineering, Physics, Chemistry.
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<p>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.</p> <p>2 Belov P.N. Numerical methods of weather forecasting.-L.: Gidrometeoizdat, 1975. -392s.,</p> <p>3 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. L: Gidrometeoizdat, 1989.</p> <p>4 Belov P.N., Borisenkov E.P., Panin B.D. Numerical methods for weather forecasts. - L .: Gidrometeoizdat, 1989</p> <p>5 Weinberg M. Mathematical modelling of transport processes. Solution of nonlinear boundary value problems. 2009</p> <p>6 Volodin E.M. Mathematical modelling of the general circulation of the atmosphere. Lecture course. Institute of Computational Mathematics RAS, 2007</p>
<b>8. Content of the discipline</b>	
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.	
<b>1. Basic information about the discipline:</b>	
Name of the discipline	High-Temperature Processes and Plants
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<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 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>
<b>8. Content of the discipline</b>	
Formation of in-depth knowledge of the characteristics, principles of operation, and features of the operation of high-temperature installations. Development of skills to put into practice the principles of organizing high-temperature technological processes, determining the parameters of individual stages of processes in heat-engineering reactors, and working with block diagrams of high-temperature heat-engineering installations.	

<b>1. Basic information about the discipline:</b> Gas turbine installations for the transportation of oil and gas	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	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.
<b>8. Content of the discipline</b> Formation of in-depth knowledge of the characteristics, principles of operation, and features of the operation of high-temperature installations. Development of skills to put into practice the principles of organizing high-temperature technological processes, determining the parameters of individual stages of processes in heat-engineering reactors, and working with block diagrams of high-temperature heat-engineering installations.	
<b>1. Basic information about the discipline: Features and prospects for the development of heat and gas supply in the agro-industrial complex</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	1 Makarov, A. N. Heat transfer in electric arc and flare metallurgical furnaces and power plants. - St. Petersburg. : Lan, 2014. - 384 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 named after S. Seifullin, 2017. - 91 p.  3. Kanaev, A. T. Introduction to nanostructural materials science. - Astana: Master Po, 2018. - 232 p.
<b>8. Content of the discipline</b>	

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.	
<b>1. Basic information about the discipline: Scientific and technical problems of heat power engineering and heat technology</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering, physical and chemical methods of water treatment
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<p>1. Dikhanbaev B.I., Intensive resource and energy saving in the processing of mineral raw materials, textbook, 2018</p> <p>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.</p> <p>3. Energy otyndar : abrasive pentose [Text]: okulyk / A. M. Dostiyarov, G. A. Akimbek, B. T. Bakhtiyar; Kazakhstan Republics Bilim Zhane Gylym Minister of League, "Almaty Power Engineering Baylanys University" Commercial Emes Shareholder of Kogama. - Almaty: AEzhBU, 2020. - 218 b.</p>
<b>8. Content of the discipline</b>	
<p>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.</p> <p>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.</p>	
<b>1. Basic information about the discipline: Cycles and installations of thermal processes</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	1. Dikhanbaev B.I., Intensive resource and energy saving in the processing of mineral raw materials, textbook, 2018



	<p>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.</p> <p>3. Energy otyndar : abrasive pentose [Text]: okulyk / A. M. Dostiyarov, G. A. Akimbek, B. T. Bakhtiyar; Kazakhstan Republics Bilim Zhane Gylym Minister of League, "Almaty Power Engineering Baylanys University" Commercial Emes Shareholder of Kogama. - Almaty: AEzhBU, 2020. - 218 b.</p>
<p><b>8. Content of the discipline</b>  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.</p>	
<p><b>1. Basic information about the discipline: Engineering experiment</b></p>	
<b>2. Number of credits</b>	<b>four</b>
<b>3. Prerequisites:</b>	Fundamentals of Scientific Research
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<p>1. Kanaev A. T. Fundamentals of the methodology of scientific creativity and innovation. - Astana: KazATU named after S. Seifullin, 2016. - 185 p.</p> <p>2. Fundamentals of innovative development of science and education. - Penza: Science and education, 2017. - 188 p.</p> <p>3. Alinov M. Sh . Innovation management. - Almaty: Bastau, 2012. - 204 p.</p>
<p><b>8. Content of the discipline</b>  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</p>	
<p><b>1. Basic information about the discipline: Heat supply based on renewable energy sources</b></p>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of heat engineering
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	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.

<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Butuzov, V. A. The use of solar energy for the production of thermal energy. M.: Intekhenergo-Izdat, 2015. - 304 p.</li> <li>2. Tleuov, A. Kh. Application of renewable sources of energy in the Republic of Kazakhstan. Part 1. Solar energy. - Astana: KazATU, 2017. - S. 236.</li> <li>3. Geothermal energy. ed. P. P. Bezrukikh. - M.: Heat power engineer. 2015. - 304 p.</li> </ol>
<b>8. Content of the discipline</b>	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
<b>1. Basic information about the discipline: Obtaining secondary fuel from waste processing</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Batluk V.A. Fundamentals of ecology and environmental protection. Tutorial. Lvov: Afisha, 2012. 147p.</li> <li>2. Voronkov N.A. Ecology general, social, applied: Textbook for students of higher educational institutions. A guide for teachers. M.: Agar, 1999. 97p.</li> <li>3. Demina T.A. Ecology, nature management, environmental protection. M.: Nauka, 1999. 87p.</li> <li>4. Zalkind I.Ya., Vdovichenko V.S. Ash and slag in boiler furnaces. M.: Stroyizdat, 1974. 93s.</li> <li>5. Kitaev I.V. Ash-forming and minor elements of the coals of the Far East. Vladivostok, 1989. 136 p.</li> </ol>
<b>8. Content of the discipline</b>	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.
<b>1. Basic information about the discipline: Energy-efficient enclosing structures</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel

	preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Bryukhanov O.N., Shevchenko S.N. Heat and mass transfer. - Higher education, 2012</li> <li>2. Theory of heat and mass transfer / Edited by A.I. Leontiev. M.: Higher school, 2004. - 495 p.</li> <li>3. Kutateladze S.S. Fundamentals of the theory of heat transfer.- M.: Atomizdat, 2006.- 425 p.</li> </ol>
<b>8. Content of the discipline</b>	Formation of in-depth knowledge: in the field of heat and mass transfer; on the current level of development of enclosing structures of buildings and structures; about the theory of state and moisture transfer in building materials; about patterns of moistening of enclosing structures; on the main directions of energy saving in the improvement of the enclosing structures of buildings due to the fullest possible consideration of the physical factors acting in the enclosing structures.
<b>1. Basic information about the discipline: Calculations of heat transfer in enclosing structures</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Bryukhanov O.N., Shevchenko S.N. Heat and mass transfer. - Higher education, 2012</li> <li>2. Theory of heat and mass transfer / Edited by A.I. Leontiev. M.: Higher school, 2004. - 495 p.</li> <li>3. Kutateladze S.S. Fundamentals of the theory of heat transfer.- M.:</li> </ol>

	Atomizdat, 2006.- 425 p.
<b>8. Content of the discipline</b>	
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 the laws of moistening building envelopes, about the main directions of energy saving when improving building envelopes due to full accounting physical factors.	
<b>1. Basic information about the discipline: Approximate methods for solving heat engineering problems</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<p>Know computer technologies and programs for thermal calculations and processing of research results, and apply methods of mathematical analysis and modelling.</p> <p>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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Alinov, M. Sh. Fundamentals of energy saving and energy efficiency: textbook. allowance / M. Sh. Alinov; Ministry of Education and Science Rep. Kazakhstan. - Almaty: Bastau, 2015. - 288 p.</li> <li>2. Dostiyarov, A. M. Guidelines for laboratory work on the disciplines "Boiler plants and steam generators" and "Special issues of <b>fuel combustion</b> " for students of the speciality 5B071700 - " <b>Heat power</b> " - Astana: KATU n. S. Seifullina, 2017. - 38 p.</li> <li>3. Askarova, A. S. Modeling of combustion in the combustion chambers of coal-burning <b>thermal power plants</b> - Almaty: Kazakh University, 2015. - 143 p.</li> </ol>
<b>8. Content of the discipline</b>	
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 mastering the methods and techniques of analogue, physical and mathematical modelling of processes, apparatuses and systems of heat power engineering and heat technology, and the skills of conducting a computational experiment.	
<b>1. Basic information about the discipline: Technological methods for reducing the formation of harmful emissions at thermal power plants</b>	
<b>2. Number of credits</b>	<b>5</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering

<b>7. Basic literature</b>	<p>1. Tupov, V. B. Factors of physical impact TPP on the environment. - M.: MEI, 2012. - 284 p.</p> <p>2. Voronkov N.A. Ecology general, social, applied: M.: Agar, 1999.</p> <p>3 . G.M. Tyutebaev. Educational and methodological complex in the disciplines "Implementation of technological processes and environmental technologies for fuel combustion ", Astana: KazATU named after. S. Seifullin, 20 19.</p>
<b>8. Content of the discipline</b>	
Formation of undergraduates: a clear understanding of the principles of environmental engineering policy, properties and interaction of the environment with industrial production; knowledge of the basics of operation and adjustment of various types of environmental devices; skills in choosing the most environmentally efficient construction of a heat engineering process, developing an effective way to suppress the formation of harmful substances and methods for cleaning emissions from thermal power plants.	
<b>1. Basic information about the discipline: Ways of development of low-power boilers</b>	
<b>2. Number of credits</b>	<b>four</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies
<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<p>1. A.L. Toropov Wall-mounted gas boilers for autonomous heating systems. M . 2020.</p> <p>2. 1. Thermal power plants: a textbook for universities / VD Burov [et al.]; ed. V. M. Lavygina, A. S. Sedlova, S. V. Tsaneva. - Moscow: MEI Publishing House, 2007. - 466 p.</p> <p>3. Kolpachkov V.I., Yashchura A.I. Production operation, maintenance and repair of power equipment. M: Energoatomizdat. 2001 - 179s</p>
<b>8. Content of the discipline</b>	
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.	
<b>1. Basic information about the discipline: Designs of furnace and burner devices for heat supply to buildings and structures</b>	
<b>2. Number of credits</b>	<b>four</b>
<b>3. Prerequisites:</b>	Theoretical foundations of TPP, Technological foundations of fuel preparation, Environmental protection
<b>4. Postrequisites:</b>	Disciplines of doctoral studies

<b>5. Competencies:</b>	<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>
<b>6. Author of the course</b>	Department of Thermal Power Engineering
<b>7. Basic literature</b>	<ol style="list-style-type: none"> <li>1. Askarova, A.S. Modeling of combustion in the combustion chambers of coal-burning TPPs. - Almaty: Kazakh University, 2015. - 143 p.</li> <li>2. 1. Thermal power plants: a textbook for universities / VD Burov [et al.]; ed. V. M. Lavygina, A. S. Sedlova, S. V. Tsaneva. - Moscow: MEI Publishing House, 2007. - 466 p.</li> <li>3. Kolpachkov V.I., Yashchura A.I. Production operation, maintenance and repair of power equipment. M: Energoatomizdat. 2001 - 179s</li> </ol>
<p><b>8. Content of the discipline</b>  Formation among undergraduates of competencies in the field of designs of furnace and burner devices for heat supply of buildings and structures for various purposes using the possibilities of resource and energy saving, as well as renewable energy sources based on waste disposal and recycling.</p>	