**Institute** of Energy and mechanical named after A. Burkitbayev
**Department** of Power Engineering

# EDUCATIONAL PROGRAM

6B07122 - «Heat Power Engineering»
**the cipher and the name of the educational program**

Code and classification of the field of education: **6B07 Engineering, manufacturing and construction industries**

Code and classification of training directions: **6B071 Engineering and Engineering**

Group of educational programs: **B062 Electrical Engineering and Power Engineering**

Level based on NQF: **level 6**

Level based on IQF: **level 6**

Study period: **4 years**

Amount of credits: **240**

**Almaty 2025**

**Educational program 6B07122 - «Heat Power Engineering»**
code and name of educational program
was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes №10 dated «06» 03 2025.

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

Minutes №3 dated «20» 12 2024.

**Educational program 6B07122 - «Heat Power Engineering»**
code and name of educational program
was developed by Academic committee based on direction «Engineering and Engineering»

| | Full name | Academic degree/ academic title | Post | Place of work | Signature |
|---|---|---|---|---|---|
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## List of abbreviations and designations

EP – educational program
BC – basic competencies
PC – professional competencies
LO – learning outcomes
MOOC – massive open online courses
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework
SDG - Sustainable Development Goals

# 1. Description of educational program

The educational program is designed to train personnel to work in production workshops and engineering departments of thermal and nuclear power plants, industrial heating boilers and enterprises of the energy, metallurgical, mining and processing, oil and gas industries and in the housing and utilities sector, as well as in production laboratories, energy and environmental expertise, environmental, energy, housing and communal services.

The direction of the specialty and specialization program covers engineering and engineering.

In case of successful completion of the full bachelor's degree course, the graduate is awarded the academic degree "Bachelor of Engineering and Technology in the field of Thermal Power Engineering".

The volume of mathematical, natural science, basic and language disciplines has been increased in the educational program. Profile disciplines have been added, which can be divided into two groups: disciplines on thermal power engineering and disciplines on alternative energy. The result was an educational program that has innovative and practical content and is aimed at implementing the Digital Kazakhstan program.

The educational program provides for the study of the following innovative disciplines:

- thermodynamic cycles of thermal machines and cooling processes - energy audit and energy saving at enterprises;
- solar installations and heat pumps;
- industrial and domestic thermal power equipment;
- hydro-gas dynamics of media in thermal power plants;
- calculation and design of heat and mass transfer equipment;
- heat supply systems of enterprises;
- heating networks and heat supply systems of enterprises and housing and communal services;
- combined-cycle and gas turbine installations of thermal power plants and nuclear power plants;
- operation of the main TPP equipment;
- heat and mass transfer equipment of the enterprise;

In the process of mastering the educational program, a bachelor of Engineering and technology in the field of thermal power engineering should have the following key competencies.

The bachelor must:

*have an idea:*

- about modern thermal power facilities, about autonomous power sources and renewable energy facilities, about promising areas of energy development;
- on modern approaches to the calculation and design of thermal power systems, as well as to the use of software tools for the management and evaluation of energy systems;

- about modern elements and installations of thermal power systems (devices, apparatuses, equipment, etc.).

*To know:*

- theoretical and experimental research methods for the purpose of creating new promising areas in the field of thermal power engineering;
- principles of operation, technical characteristics and design features of the developed and used energy facilities;
- standards, methodological and regulatory materials, fundamentals of design, installation and operation of thermal engineering installations of the thermal power industry;
- modern and promising directions of development of heat power and heat technology systems, principles of operation, technical characteristics and design features of the developed and used heat power and heat technology installations and systems;
- determine the thermodynamic properties of substances, calculate the main parameters of the cycles of heat and refrigeration machines, use tables and diagrams of the state of substances.

*be able to:*

- to develop the principles of organization and design of thermal power plants;
- use application software packages for calculations, modeling and automation of design of thermal power systems;
- use theoretical information on the organization of the technological process of heat and electricity generation at thermal power plants;
- apply methods to increase the economic efficiency of municipal heat power by using new renewable energy sources, methods for calculating heat exchangers, techniques for using heat power equipment and systems;
- to solve the main issues of heating and heat supply systems, design features of internal heat supply systems, heating networks, equipment of heating points;
- use methods for calculating heat and power supply.
- apply methods and measuring instruments used in the production and consumption of thermal and electrical energy;
- use energy- and resource-saving technologies, conduct a preliminary feasibility study of design calculations;
- to carry out calculations on the heat consumption of thermal power plants.

*have skills:*

- formulate the main technical and economic requirements for the designed heat power systems;
- organization of work on the operation, installation and commissioning of electrical and thermal equipment;
- development and design on the modern element and technical basis of energy systems and individual devices.
- possess modern methods and devices for monitoring and accounting of energy carriers.

- calculate energy losses through heat transfer, radiation, convection, and determine heat losses of various building structures.

During the training, production practices are provided at such enterprises as: NC KEGOC, JSC AZHK, JSC AlES, Almaty Thermal Networks LLP, JSC Kazatomprom, Kazzinc LLP, Karachaganak Petroleum Operating and others.

## 2. Purpose and objectives of educational program

**Purpose of EP:** The purpose of the educational program is to teach students general education, basic and specialized disciplines with the achievement of appropriate competencies. Preparation of bachelors with professional knowledge in the design, installation, operation and repair of equipment for thermal and nuclear power plants, power supply sources for industrial enterprises and settlements, who have an idea of the classical and new directions of modern energy and environmental technologies, and are able to apply the knowledge gained in scientific, practical and industrial activities.

**SDG 4 – Quality Education:** To adapt learners to the requirements of modern production by developing engineering thinking, digital literacy and professional skills;

**SDG 7 – Affordable and Clean Energy:** Design of heat exchangers that use energy efficiently and can work with renewable energy sources;

**SDG 9 – Industry, Innovation and Infrastructure:** Design innovative solutions in the field of heating technology, use of digital technologies and artificial intelligence;

**SDG 12 – Responsible Consumption and Production:** Ensure sustainable production through the economical use of materials and reducing harmful impacts on the environment.

**SDG 13 – Climate Action:** Understanding thermal processes helps develop solutions to reduce greenhouse gas emissions and improve energy efficiency.

**Tasks of EP:** Theoretical and practical training of highly qualified bachelors of heat power engineering, capable of performing tasks of the entire complex of engineering issues of heat supply, using modern computer technology and introducing new technologies in design.

## 3. Requirements for evaluating the educational program learning outcomes

Admission to the university is carried out according to the applications of an applicant who has completed secondary, secondary special education in full on a competitive basis in accordance with the points of the certificate issued according to the results of the unified national testing with a minimum score of at least 65 points.

Special requirements for admission to the program apply to graduates of 12 summer schools, colleges, applied bachelor's degree programs, niches, etc. Such applicants must pass diagnostic testing in English, mathematics, physics and special disciplines.

Rules for credit transfer for accelerated (reduced) education based on 12-year secondary, secondary technical and higher education

| Code | Competence type | Description | Competence result | Responsible |
|---|---|---|---|---|
| Shared (Includes full training with possible additional, depending on the level of knowledge) | | | | |
| G1 | Communication | - Fugitive monolingual oral, written and communication skills<br>- The ability not to communi-cate fluently with a second language<br>- The ability to use communi-cative communication in different situations<br>- There are basics to acade-mic writing in their native language<br>- Diagnostic language test | Full 4-year study with a minimum of 240 academic loans (of which 120 contact classroom academic credits) with a possible re-recording of loans in the second language where students have an advanced level. The level of language is determined by passing the diagnostic test | Department of Kazakh and Russian, Department of English |
| G2 | Mathematical Literacy | - Basic mathematical thinking at the communication level<br>- the ability to solve situational problems on the basis of the mathematical apparatus of algebra and began mathematical analysis<br>- Diagnostic test for mathe-matical literacy in algebra | Full 4-year study with a minimum of 240 academic loans (of which 120 are contact auditary academic loans). With a positive test of diagnostic test, the level of mathematics 1, the negative - the level of algebra and the beginning of the analysis | Mathematics Department |
| G3 | Basic literacy in science disciplines | - A basic understanding of the scientific picture of the world with an understanding of the basic laws of science<br>- Understanding basic hypotheses, laws, methods, drawing conclusions and assessing errors | Full 4-year study with a minimum of 240 academic loans (of which 120 are contact auditary academic loans). With a positive test of diagnostic test level Physics 1, General Chemistry, at negative - the level of the Beginning of Physics and basic basics of chemistry | Departments in the fields of natural sciences |

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| Specific<br>(includes reduced tuition by re-counting credits depending on the level of competence knowledge for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas) | | | | |
| S1 | Communication | - Fugitive bilingual oral, written and communication skills<br>- The ability not to communi-cate fluently with a third language<br>- writing skills of different styles and genres<br>- skills of deep understanding and interpretation of one's own work of a certain level of complexity (essay)<br>- basic aesthetic and theore-tical literacy as a condition of full perception, interpretation of the original text | Full re-repayment of credits by language (Kazakh and Russian) | Department of Kazakh and Russian |
| S2 | Mathematical Literacy | - Special mathematical thin-king using induction and deduction, generalization and specification, analysis and synthesis, classification and systematization, abstraction and analogy<br>- The ability to formulate, substantiate and prove positions<br>- Application of common mathematical concepts, formulas and extended spatial perception for mathematical tasks<br>- Full understanding of the basics of mathematical analysis | Re-credit for The Discipline of Mathematics (Calculus) I | Mathematics Department |
| S3 | Special literacy in science disciplines (Physics, Chemistry, Biology and Geography) | - A broad scientific percep-tion of the world that suggests an understanding of natural phenomena<br>- Critical perception to understand the phenomena of the world around<br>- cognitive ability to formulate a scientific understanding of the forms | Re-credits for Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Training practice, etc. | Departments in the fields of natural sciences |

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| | | of existence of matter, its interaction in nature | | |
| S4 | English language | - Readiness for further self-learning in English in various fields<br>- Ready to gain experience in design and research using English | Refilort English credits above academic to professional level (up to 15 credits) | Department of English |
| S5 | Computer skills | - Basic programming skills in one modern language<br>- Use software and applications to teach different disciplines | Reset Credits on Discipline Introduction to Information and Communication Technologies, Information and Communication Technologies | Department of Software Engineering |
| S6 | Social and humanitarian competencies and behaviour | - Understanding and understanding the responsibility of every citizen for the development of the country and the world<br>- The ability to discuss ethical and moral aspects in society, culture and science | Re-credit for Kazakhstan's Modern History (excluding state exam) | Department of Public Discipline |
| | | - Critical understanding and the ability to debate on modern scientific hypotheses and theories | Re-credit credits for philosophy and other humanities | |
| PROFESSIONAL (includes reduced education by re-counting credits depending on the level of knowledge on competences for college graduates, AV schools, universities) | | | | |
| P1 | Professional competencies | - Critical perception and a deep understanding of professional competencies at level 5 or 6<br>- The ability to discuss and debate professional issues within the framework of the mastered program | Re-credits for basic professional disciplines, including introduction to specialty, engineering ethics, robotic technology, automation technology, theoretical basics of electrical engineering, technological measurements and instruments, mathematical basics of control theory, electronic automation devices. | Releasing chair |
| P2 | General Engineering Competencies | - Basic general engineering skills and knowledge, the ability to solve general engineering problems and problems<br>- be able to use application packages to | Re-credit for general engineering disciplines (engineering graphics, outline geometry, electrical engineering basics, microelectronics basics.) | Releasing chair |

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| | | process experimental data, solve algebraic and differential equation systems | | |
| P3 | Engineering and computer competencies | - Basic skills in using computer programs and software systems to solve general engineering problems | Re-credit for computer graphics discipline, computer modeling and programming in the MatLab environment. | Releasing chair |
| P4 | Socio-economic competences | - Critical understanding and cognitive ability to reason on contemporary social and economic issues<br>- A basic understanding of the economic assessment of research sites and the profitability of projects. | Re-transfer credits for socio-humanitarian and technical and economic disciplines in the set-off of the electorate cycle | Releasing chair |

The university may refuse to re-borrow credits if the low diagnostic level is confirmed or the final grades were lower than A and B.

## 4. Passport of educational program

**4.1.** General information

| № | Field name | Comments |
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| 1 | Code and classification of the field of education | 6B07 Engineering, manufacturing and construction industries |
| 2 | Code and classification of training directions | 6B071 Engineering and Engineering |
| 3 | Educational program group | B062 Electrical Engineering and Power engineering |
| 4 | Educational program name | Heat power engineering |
| 5 | Short description of educational program | The educational program is designed to train personnel to work in production workshops and engineering departments of thermal and nuclear power plants, industrial heating boilers and enterprises of the energy, metallurgical, mining and processing, oil and gas industries and in the housing and utilities sector, as well as in production laboratories, energy and environmental expertise, environmental, energy, housing and communal services.<br>The direction of the specialty and specialization program covers engineering and engineering.<br>In case of successful completion of the full bachelor's degree course, the graduate is awarded the academic degree "Bachelor of Engineering and Technology in the field of Thermal Power |

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| | | Engineering".<br>The volume of mathematical, natural science, basic and language disciplines has been increased in the educational program. Profile disciplines have been added, which can be divided into two groups: disciplines on thermal power engineering and disciplines on alternative energy. As a result, we have an educational program that has innovative and practical content and is aimed at implementing the Digital Kazakhstan program. |
| 6 | Purpose of EP | The purpose of the educational program is to teach students general education, basic and specialized disciplines with the achievement of relevant competencies. Theoretical and practical training of highly qualified bachelors of heat power engineering, capable of performing tasks of the entire complex of engineering issues of heat supply, using modern computer technology and introducing new technologies in design. Preparation of bachelors with professional knowledge in the design, installation, operation and repair of equipment for thermal and nuclear power plants, power supply sources for industrial enterprises and settlements, who have an idea of the classical and new directions of modern energy and environmental technologies, and are able to apply the knowledge gained in scientific, practical and industrial activities.<br>SDG 4 – Quality Education: To adapt learners to the requirements of modern production by developing engineering thinking, digital literacy and professional skills;<br>SDG 7 – Affordable and Clean Energy: Design of heat exchangers that use energy efficiently and can work with renewable energy sources;<br>SDG 9 – Industry, Innovation and Infrastructure: Design innovative solutions in the field of heating technology, use of digital technologies and artificial intelligence;<br>SDG 12 – Responsible Consumption and Production: Ensure sustainable production through the economical use of materials and reducing harmful impacts on the environment.<br>SDG 13 – Climate Action: Understanding thermal processes helps develop solutions to reduce greenhouse gas emissions and improve energy efficiency. |
| 7 | Type of EP | New EP |
| 8 | The level based on NQF | level 6 |
| 9 | The level based on IQF | Level 6 |
| 10 | Distinctive features of EP | No |
| 11 | List of competencies of educational program | A - knowledge and understanding:<br>A1 - methods of building electrical, technological and |

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| | | functional schemes for the design of Power Engineering systems;<br>A2 - current trends in the development of technical and technological systems of Power Engineering facilities;<br>A3 - standards, methodical and regulatory materials accompanying the operation, installation and installation of thermal power and Electric Power Engineering facilities.<br><br>B - applying knowledge and understanding:<br>B1 - independent work and offer various options for solving professional problems using theoretical and practical knowledge;<br>B2 - to organize installation, installation and operation of Electric Power Engineering and thermal systems;<br>B3 - to organize the collection, storage and processing of information used in the field of professional activity.<br><br>C - the formation of judgments:<br>C1 - about modern Power Engineering industry facilities and process management systems;<br>C2 - on the application of modern autonomous Power Engineering systems of different categories of consumer approaches;<br>C3 - about modern technical devices and technological equipment of Power Engineering facilities (devices, devices, conductors, equipment, executive mechanisms, microprocessors, etc.).<br><br>D - personal abilities:<br>D1 - to be an Power Engineering engineer, electrical engineer of the production division of the operation of Power Engineering systems;<br>D2 - to be a specialist in the maintenance of electrical and thermal networks, and systems;<br>D3 - to be an engineer of the production unit for the repair of thermal and electrical installations;<br>D4 - to be able to organize work on setting up Power Engineering and electromechanical plants of industrial enterprises.<br><br>***Competences at the end of training***<br>B - Basic knowledge, skills andskills:<br>B1 is capable of philosophical analysis of social phenomena, personality behavior and other phenomena. I am ready to conduct a philosophical assessment of social phenomena;<br>B2 - to know and apply in practice the basics of engineering professional ethics;<br>B3 - to be able to analyze the current problems of the |

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| | | modern history of Kazakhstan.<br><br>P - Professional competencies, including in accordance with the requirements of industry professionalstandards:<br>P1 is a wide range of theoretical and practical knowledge in the professional field;<br>P2 - is able to analyze and solve problems on the theory of electrical circuits and heat technology;<br>P3 - is able to analyze thermal, electrical and installation schemes of technological production. I am ready to install, set up and operate thermal and electrical installations, and systems.<br><br>O - Human, social and ethicalcompetences:<br>O1 - is able to freely use english as a means of business communication, a source of new knowledge in the field of electrical engineering and Power Engineering. I am ready to use the English language in the professional activities in the field of Electric Power Engineering and heat Power Engineering;<br>O2 - is able to freely master the Kazakh (Russian) language as a means of business communication, a source of new knowledge in the field of electrical engineering and Power Engineering. I am ready to use the Kazakh (Russian) language in professional activities in the field of Electric Power Engineering and heat Power Engineering;<br>O3 - to know and apply in work and life the basics of applied ethics and ethics of business communication;<br>O4 - to know and apply the basic concepts of professional ethics;<br>O5 - to know and apply in practice the "code of conduct of engineer";<br>O6 - to know and solve the problems of human influence on the environment.<br><br>C - Special and Management Competencies:<br>C1 - self-management and control of work and training processes within the framework of the organization's strategy, policies and objectives, discussion of the problem, reasoning of conclusions and competent operation of information;<br>C2 - *in the field of organizational and management activities:* to be the head of the group of the division for the operation, installation and repair of power plants in various industries;<br>C3 - *in the field of experimental research:* to be a specialist in experimental research of thermal and electric power facilities;<br>C4 - *in the field of research:* to be an engineer of a scientific laboratory for the research and development |

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| | | of modern Power Engineering installations and systems in various industries;<br>C4 - in the field *of design:* to be an engineer in the development and design of electric power plants, and systems in various industries.. |
| 12 | Learning outcomes of educational program: | General standard requirements for graduation and awarding a bachelor's degree: mastering at least 240 academic credits of theoretical training and final diploma work or state exam in specialty.<br>Special requirements for graduating from university under this program<br>*graduate should know:*<br>Organizes knowledge to support development goals, including improving the quality of education. Assesses heat losses in buildings through transmission, radiation, and convection, applying them to address sustainability and energy efficiency challenges.<br>Uses theoretical information on the organization of the technological process of heat and electricity generation at thermal power plants, understands the principle of operation and design of various thermal power devices and mechanisms<br>Applies methods for calculating the flow of liquid and gas in channels, pipes, nozzles, diffusers and other elements. Performs hydraulic calculations of industrial thermal power equipment. Analyzes the physico-chemical properties of water and fuel, methods of their research, laws of motion of liquids and gases.<br>Performs calculations of thermal characteristics of fuels and their combustion products, thermal calculations of a steam boiler and its individual heating surfaces. He is able to calculate and select superchargers and heat engines depending on their purpose, to carry out thermal and strength calculations of superchargers and heat engines. Applies methods of calculation of furnace processes, methods of analysis of constructive and technological factors affecting the efficiency of gorenje processes.<br>Can use electrical and electronic devices. Owns methods of calculation of linear electrical circuits, resonant circuits, transient and pulse characteristics, the study of three-phase circuits, electrical filters. Develops programs for processing digital information using modern software products and technologies<br>Implements innovative approaches in practical activities to achieve concrete results in the field of thermophysics and heat technologies. Independently processes and makes the right decision when creating or mastering new technologies and materials. Uses knowledge of fundamental sections of natural science |

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| | | and professional disciplines to understand the physical essence of the processes occurring in the objects of the main and auxiliary equipment of thermal power plants.<br>Performs calculations for solar, wind and bioenergy installations, develops energy saving measures to ensure affordable and clean energy. Selects ways to reduce emissions and pollution, contributing to the fight against climate change and responsible consumption. Designs engineering and sanitary solutions for the environmental safety of production facilities, supporting the sustainable development goals of sustainable cities and clean water.<br>It shows knowledge about society as an integral system and a person, the role of spiritual processes in modern society, the legal interests of the parties in the field of protecting the rights of individuals and legal entities, economic and social conditions for doing business, the impact of harmful and dangerous factors on humans and the natural environment. Possesses basic knowledge in the field of mathematics, natural sciences, contributing to the formation of a highly educated personality with a broad outlook and a culture of thinking. Conducts physical experiments, work with measuring instruments, perform calculations and process the received data. Conducts a chemical experiment, observing safety regulations, apply the laws of chemistry when solving computational problems<br>He is able to use theoretical information on the organization of the technological process of generating heat and electricity at thermal power plants. Applies methods of increasing the economic efficiency of municipal heat power engineering through the use of new renewable energy sources, methods of calculating heat exchangers, techniques for using heat power equipment and systems.<br>Determines the thermodynamic properties of substances, calculate the main parameters of the cycles of heat and refrigeration machines, use tables and diagrams of the state of substances. Owns modern methods and devices for monitoring and accounting of energy carriers. Knows and owns modern and promising areas of development, principles of operation, technical characteristics and design features of nuclear and nuclear power plants.<br>Applies methods and means of measurement used in the production and consumption of thermal and electrical energy. He is able to use energy- and resource-saving technologies, conduct a preliminary feasibility study of design calculations. Performs |

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| | | constructive and verification calculations of heat exchangers. Is able to carry out calculations on the heat consumption of thermal power plants<br>Analyzes the situation from the point of view of its safety for production workers and the population, as well as in the development of measures to reduce the levels of exposure to harmful factors. Performs calculations of hydraulic and temperature modes of operation of open systems of municipal heat supply. Performs a rational layout of the components and equipment. Selects the basic principles of the organization of the production process. It is able to calculate the power and number of heating and ventilation devices, the type and location of these devices.<br>Possess basic knowledge in the field of natural sciences that contribute to solving professional problems in the field of thermal energy systems and the formation of a highly educated personality with a broad outlook, with the aim of providing inclusive, fair and high-quality education and stimulating opportunities for all throughout life.<br>Uses knowledge of basic disciplines to understand the physical essence of the processes occurring in the objects of the main and auxiliary equipment of thermal power plants, heating and hot water boiler plants and steam generators.<br>Be able to organize training on life safety and labor protection, the organization of civil protection, ensuring safety from environmental and industrial factors and put into practice the skills of providing first aid to victims in emergency situations to reduce the loss of population and personnel of energy facilities<br>Ecology and life safety, the basics of anti-corruption culture, entrepreneurship and leadership, the adoption of innovations, the principles of inclusivity, critical thinking, effective interaction in the team and the use of basic knowledge in the field of Professional Ethics in various types of professional and political activities. |
| 13 | Education form | Full-time |
| 14 | Period of training | 4 years |
| 15 | Volume of loans | 240 |
| 16 | Languages of instruction | Kazakh, Russian |
| 17 | Academic degree awarded | Bachelor of Engineering and Technology |
| 1/ | Developer(s) and authors: | Sarsenbaev Ye., Umyshev D., Nygymanova A. |

## 4.2. The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines

| № | Name of the discipline | Brief description of the discipline | Number of credits | Generated learning outcomes (codes) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 | LO9 | LO10 | LO11 | LO12 | LO13 | LO14 | LO15 | LO16 |
| 1 | Fundamentals of anti-corruption culture and law | Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields. | 5 | | | | | | | | v | | | | | | | | v |
| 2 | Fundamentals of scientific research methods | Purpose: to form a systematic understanding of the methodology of scientific cognition among students; to develop scientific thinking skills; to form experience in organizing and conducting scientific research; to develop a competence-based approach to the use of methods and rules for conducting research in the field of mechanical engineering, related processes and their technologies. Contents: stages of scientific research, terms and concepts, methods of conducting an experiment, mathematical methods of processing research results. Concepts of engineering, laboratory and industrial experiment, bench research. | 5 | | | | | | | | | | | | | v | v | | |

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| 3 | Basics of Financial Literacy | Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies. | 5 | | | | | | | | v | | v | | | | | | v |
| 4 | Fundamentals of economics and entrepreneurship | Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making. | 5 | | | | | | | | v | | | v | | | | | |
| 5 | Ecology and life safety | Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature. | 5 | | | | | | | v | | | | | | | | v | |

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| 6 | Renewable energy | The study of the physical nature of the processes of conversion of renewable energy sources (RES) into electrical energy and the implementation of the most economical and safe conditions for operating power plants based on renewable energy. Formation of graduates' readiness to conduct a feasibility analysis, comprehensively justifying the decisions made and implemented in the field of operation of power plants based on renewable energy sources; application of results in practice, the desire for self-development, improvement of their skills and skills - rational use of technological processes and methods for the production and transmission of electricity; possess the method of calculating the design and optimal analysis of power supply systems, acquire knowledge and practical skills for reliable and safe operation of electrical equipment operating on the basis of renewable energy sources. | 5 | | | | | | | v | | v | | | | | | | |
| 7 | Boiler Plants and Steam Generators | Bailer plants and steam generators course consists of several parts: Technological scheme of the boiler, Technical characteristics of the fuels and the use of the boiler efficiency, Calculation of the heat of the heating boiler, The structures of the boilers, Calculation of boiler plants hydraulic and aerodynamic, Boilers of industrial and technological systems, Use boilers of industrial enterprises. | 5 | | | | | | | | | | | | | | v | | | |

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| 8 | Mathematics I | Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables. | 5 | | | | | | | | | | | | | v | | | |
| 9 | Mathematics II | Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations_ | 5 | | | | | | | | | | | | | v | | | |

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| 10 | Mathematics III | Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive.The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied. | 5 | | | | | | | | | | | | | | v | | | |
| 11 | Materials science in thermal power engineering | When studying the discipline, students should learn, as a result of analyzing the operating conditions, to choose the material and method of manufacturing parts and products using modern technological processes, to choose optimal methods for studying the properties and structure of materials, to determine the mechanical properties of materials, to analyze the structure of materials, to process the experimental results obtained, to analyze technical information in the field of materials science and technology of structural materials. Fundamentals of theoretical and experimental research of processes and equipment of thermal power engineering and heat engineering; theory of development of optimal engineering solutions taking into account limitations, theory of solving inventive tasks; methodology for conducting a preliminary feasibility study of design solutions; the main global trends in the development of low-waste, energy-saving and | 5 | | | | | | v | | | | | | | | | | | |

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| | | environmentally friendly resource-efficient technologies in thermal power engineering; criteria for the selection and creation of thermal power equipment. | | | | | | | | | | | | | | | | | | |
| 12 | Blowers and temple engines | Considers pumps, compressors, the principle of their work, as well as the work of heat engines, which include gas and steam turbines. As part of the course, students become familiar with the principles of their work and methods for calculating them, the working conditions of the main elements of superchargers and heat engines, the principles of designing superchargers and heat engines, technologies for manufacturing machine parts, structures for controlling the operation of superchargers and heat engines. | 4 | | | | v | | | | | | | | | | | | | |
| 13 | Theoretical fundamentals of heat engineering | Students should have an understanding of the principles of operation of combined-cycle plants, in particular, waste heat boilers, gas-gas, gas-water and other types of heat exchangers; Know the basic laws and concepts of heat and mass transfer; thermal characteristics of bodies and media; equations of the system parameters. To be able to use the basic provisions and laws of heat engineering for the analysis of heat transfer processes; use tables and diagrams, calculate cycle efficiency based on heat exchange processes. | 4 | | | v | | | | | | v | | | | | | | | |
| 14 | Heat and Mass Exchange Equipment in Industrial Heat Power Engineering | The main types and classification of heat and mass transfer equipment are considered, as well as formed the skills of their calculation and selection. Attention is paid to the operation features of various types of heat exchangers; evaporation and desalination plants; auxiliary equipment of heat-consuming plants; Physico-chemical processes in them, and ways of their | 5 | v | | | | | | | | v | | | | | | | | |

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| | | intensification. Information on heat carriers, their properties and characteristics are given. The methods of calculation of heat and mass transfer equipment are studied, they are: thermal, constructive, verification, hydraulic, strength, technological and economic. | | | | | | | | | | | | | | | | | | | |
| 15 | Thermal engineering measurements and control | The necessary knowledge on the theory and methods of measurement, methods for assessing the accuracy and reliability of measuring instruments and systems, on the state standardization system, on methods for evaluating product quality. Fundamentals of control of technological objects; thermal engineering control objects, their main features; control in start-up, stop and normal operation modes; decomposition of control objectives; automation of control; the concept of dynamic systems and types of dynamic systems; mathematical models of technological control objects; | 5 | | | | | | v | | | | | | | | | | | | |
| 16 | Engineering Thermodynamics | Purpose of the discipline: understanding the fundamental principles and laws of thermodynamics necessary for the analysis and optimization of energy systems and processes. Brief contents: introduction to basic thermodynamics concepts, first and second laws, Carnot and Rankine cycles, properties of ideal and real gases, thermodynamics of phase transitions and chemical reactions, analysis and calculation of energy installations and heat exchangers. | 5 | v | | | | | | | | | v | | | | | | | | |
| 17 | Physics I | Purpose: to study the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. | 5 | | | | | | v | | | | | | | v | | | | | |

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| | | Contents: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular-kinetic theory and thermodynamics, transfer phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations. | | | | | | | | | | | | | | | | | | |
| 18 | Physics II | Purpose: to form students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a system of professional activity. Contents: harmonic oscillations, damped oscillations, alternating current, wave motion, laws of refraction and reflection of light, quantum optics, laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity. | 5 | | | | | | v | | | | | | | | v | | | |
| 19 | Electrical and Electronic Engineering | The purpose of the discipline is to acquire theoretical and practical knowledge on the basics of electrical engineering and electronics. The basic laws of the processes occurring in electromagnetic and electronic circuits and methods for determining the electrical quantities characterizing these processes are studied. Methods of calculation of DC electric circuits are studied; analysis and calculation of linear AC circuits; analysis and calculation of magnetic circuits. Electromagnetic devices and electrical machines. Fundamentals of electronics and electrical measurements. The element base of modern electronic devices. Fundamentals of digital and microelectronics, microprocessor tools. | 6 | | | | | v | | | | | | | | | | | | |
| 20 | Industrial Energy Audit | The following issues are discussed: regulatory | 5 | | | | | | | v | | | | | | | | | | |

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| | and Energy-Saving | framework for energy saving and its development trends, contractual relations of consumers with energy supplying organizations and settlement of disputable situations, tariffs and price categories for electric energy, the structure of a mandatory energy audit and an algorithm for its implementation with the development of a program for energy efficiency hanging and filling in the energy passport of the consumer of fuel and energy resources. Special attention is paid to the calculation of energy efficiency indicators, the feasibility study of organizational, technical, investment energy saving measures and the development of a program to improve energy efficiency. | | | | | | | | | | | | | | | | | | |
| 21 | Energy conversation in heat power and heat engineering | Knowledge for the development of theoretical and practical knowledge on energy efficiency, energy conversion, energy audits and energy-audit facilities, energy-saving technologies. | 5 | | | | | | | v | | | | v | | | | | | |
| 22 | Solar installations and heat pumps | Discipline studies the fundamentals of solar design, i.e. solar generators and collectors, as well as heat pumps. Solar installations are designed to produce hot water or heated air and include a solar energy collector (CSE), heat exchangers, a storage tank, heat pumps and pipelines. The working fluid (coolant) in the CSE can be water, air, organic low-boiling liquids. | 5 | | | | | | | v | | | | | | | | | | |
| 23 | Hydrogasodynamics of media in heat power plants | The physical properties of liquids and gases, the general laws of hydrodynamics and fundamental applied problems that are most relevant to heat and power engineering are considered: the theory of hydraulic resistance, one-dimensional and plane viscous flows. liquids and gases, potential flows of incompressible medium, flow in pipes, boundary layer theory, etc. | 5 | | | v | | | | | | | v | | | | | | | |

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| 24 | Modeling in power systems | Acquaintance of students with the basic elements of electric power systems (EPS) and their mathematical and virtual models, the development of students' skills in modeling electric power objects in the MATLAB software environment. The course covers the following main topics: modeling single-phase and three-phase power transformers, modeling DC machines in generator and motor modes, modeling asynchronous machines in generator and motor modes, simulating synchronous machines in generator and motor modes, modeling power lines, modeling loads, and modeling switching devices . | 5 | | | | v | v | | | | | | | | | | | | |
| 25 | Fundamentals of Artificial Intelligence | Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems. | 5 | | | | | | v | | | | | | | | | | v | |
| 26 | Fundamentals of the theory of fuel combustion and the combustion device | Considers the combustion processes of liquid, solid and gaseous fuels, as well as the associated conditions for optimal combustion. The devices ensuring the burning of various types of fuels are considered. The principles of operation of fuel burning devices, their main design features. Features of burning fuels of various aggregative state. Chemical combustion processes, optimal combustion conditions. Torch, combustion zone, oxidizers. | 5 | | | | v | | | | | | | | | | | | | |

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| 27 | Fundamentals of sustainable development and ESG projects in Kazakhstan | Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations. | 5 | | | | | | v | | v | v | | | | | | | | |
| 28 | Steam-gas and gas-turbine facilities for heat and nuclear power plants II | The fundamentals and types of steam and gas turbines are considered, which are used in the field of power engineering, structure and thermal schemes, additional devices and equipment of thermal power plants and nuclear power plants, as well as the use and ways of increasing the efficiency, operating modes, variable operating modes of modern steam and gas turbines. | 6 | | | v | | | | | | | v | | | | | | | |
| 29 | Transition processes in energy systems | The discipline "Transients in Power Systems" is Variable discipline, forming students' willingness to learn theoretical knowledge, practical skills and skills of using calculation algorithms electromagnetic transients arising from short circuits and other violations of the normal operation of the energy system, as well as knowledge necessary for understanding transients in electromechanical systems and their resistance to change of operating modes and deviations of the operating mode from normal. | 5 | | | | | | v | | | | v | | | | | | | |
| 30 | Legal regulation of intellectual property | Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including | 5 | | | | | | | | | | | | | | | | v | v |

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| | | basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Content: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them. | | | | | | | | | | | | | | | | | | | |
| 31 | Industrial and domestic heat and power equipment | The main purpose of the discipline of industrial and domestic heat power equipment is to study the operation and basic structure of the main and auxiliary equipment of heat power facilities, thermal power plants and to get acquainted with centralized Heat Supply Systems of enterprises and cities, to solve problems, to study general industrial and domestic heat power equipment | 5 | | v | | | | | | | | | | | | | | | | |
| 32 | Heat Supply Systems of Plant Facilities | The main heat supply systems, pipeline installation, and insulation materials are considered. The issues of energy saving during transportation of coolants are touched upon. Heat supply by means of a heat carrier to heating, ventilation, hot water supply systems of industrial buildings and technological consumers | 5 | | v | | | | v | | | | | | | | | | | | |
| 33 | Heating networks and heat supply systems of enterprises and housing and communal services | The basics of laying of heat networks are considered - types of pipelines, locations (duct and channelless), cathodic protection. Open and closed systems are considered, as well as dependent and independent schemes. | 6 | | v | | | | v | | | | | | | | | | | | |
| 34 | Heating and heating networks | Studying this discipline, students will become acquainted with the characteristics of steam and hot water consumption in industrial enterprises, the parameters of heat carriers and graphs of steam and heat consumption; schemes, designs and operating modes of steam, water and condensate networks; | 5 | | v | | | | v | | | | | | | | | | | | |

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| | | schemes, equipment and operating modes of the heat points of enterprises. | | | | | | | | | | | | | | | | | | |
| 35 | Thermodynamic cycles of heat engines and cooling processes | The discipline studies the thermodynamic processes occurring in heat engines. In particular, the processes of expansion and compression of gases, cooling and heating. The course examines the thermodynamic cycles of Brayton, Trinkler, Rankine and others. | 5 | v | | | | | | | | | v | | | | | | |
| 36 | Main Machinery Operation of Heat Power Plant | The course occupies an important place among the general technical disciplines that determine the theoretical level of professional training of specialists in the modern system of education. The main objectives of the course is the formation of knowledge in the field of operation of heat supply equipment; mastering the skills and abilities to assess the functional, quantitative and qualitative characteristics of the heating supply of devices. The discipline deals with the main equipment of thermal power plants - boilers, turbines, pumping equipment, capacitors and their operation. The issues of repair and equipment reliability are touched. | 5 | | | | | | | v | | v | | | | | | | |
| 37 | Accumulation of electric and thermal energy | The discipline studies technologies that allow generating and storing thermal energy using new and renewable technologies. Energy storage allows you to save energy and provide a reserve in the event of a sudden shutdown of the main energy source. The types of energy storage and ways of their application in all modern spheres of human activity are considered | 4 | | v | | | | | | | | | v | | | | | |
| 38 | Water Treatment | Water used on thermal power plants and industrial enterprises as a coolant-moderator, as well as the use of water for pre-cleaning (coagulation, liming, filtration), ionic exchange, membrane (reverse osmose, | 6 | | | v | | | | | | | | | | | | | |

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| | | electrodialysis, ultrafiltration), Water purification from dissolved gases, thermal desalination are the basic considered methods. | | | | | | | | | | | | | | | | | |
| 39 | Steam turbines Heat power plants and nuclear power plants | General information of steam turbines of thermal power plants and nuclear power plants. Working fluid flow equations. Conversion of flow energy taking into account the efficiency of machines. Characteristics of the parameters of the shovel machines. The maximum power of the turbine. Design schemes of machines. Calculation of the strength of the main parts and assemblies of steam and gas turbines. | 5 | | | | v | | | | | | v | | | | | | |
| 40 | Environmental Issues in Heat Power Engineering | Environmental problems during the extraction, extraction of primary thermal energy resources. Impact of TPP on the environment. Characteristics of emissions of TPP, the impact of emissions on the state of atmosphere when using solid fuel, natural gas, liquid fuel. The nature of air pollution: gaseous emissions, dust and aerosols. Greenhouse gases, acid rains, smog. Pollution of soil with waste from thermal power plants. Pollution by radioactive elements during TPP operation. Influence of pollution on living organisms, vegetation and the environment. Measures to limit emissions of harmful substances into atmosphere. Reducing emissions of sulfur dioxide. Desulphurization of flue gases. Methods for reducing nitrogen oxide emissions. Cleaning of flue gases from nitrogen oxides. Maximum allowable emission concentrations. The effect of TPP on hydrosphere. Problems of wastewater, water hydro-ash-removal, ash and slag wastes. Methods of wastewater treatment. Reduction of harmful emissions in using new combustion technologies. Calculation of | 5 | | | | | | | v | | | | | | | | v | |

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| | | pollutants emission during fuel combustion in boilers. Calculation of emissions of harmful substances into atmosphere during the fuel burning in boilers | | | | | | | | | | | | | | | | | | |
| 41 | Power and electrotechnical equimpment | The acquisition of students knowledge of the basics and trends in the development of energy and electrical equipment. Clearly understand the concept of providing consumers with electricity, understand the structure of energy and electrical equipment systems, the relationship between its various links, get an idea of the composition of electricity consumers in various sectors of the economy. Questions on the generalized electromechanical converter are considered. The device and principles of construction of electromechanic systems. Laws of electromechanics. Electrical insulation and cable technology. | 4 | | v | | | v | | | | | | v | | | | | | |
| 42 | High-temperature processes and installations | The study of this discipline will provide basic information on high-temperature heat engineering installations, on the types of installations, their characteristics, the principle of operation, the features of operation and the field of application. | 5 | | v | | | | | | | | v | | | | | | | |
| 43 | Sources and Systems of Heat Supply of Plant Facilities and Housing | Discipline studies the sources and systems of heat supply, i.e. thermal power plants and boilers. The issues of heat supply of industrial enterprises and apartment buildings are being studied. | 5 | | | | | | | | | | | | | | | | v | |
| 44 | Fundamentals of heat transformation and cooling processes | The discipline studies all types of heat transformers — refrigeration, cryogenic and heat pump installations. Analyses of their energy indicators, plant diagrams, initial equations and calculations are given. | 5 | | | | | | | | | | v | | | | | | | |
| 45 | Steam-gas and gas-turbine facilities for heat | The fundamentals and types of steam and gas turbines are considered, which are used in the | 4 | | | v | | | | | | | v | | | | | | | |

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| | and nuclear power plants I | field of power engineering, structure and thermal schemes, additional devices and equipment of thermal power plants and nuclear power plants, as well as the use and ways of increasing the efficiency, operating modes, variable operating modes of modern steam and gas turbines. | | | | | | | | | | | | | | | | | |
| 46 | Calculation and design of combined cycle plants | The discipline studies the design features of systems operating on a combined cycle. The discipline studies calculation methods for gas and steam turbines, as well as waste heat boilers. | 5 | | | | v | | | | | | | | | | | v | |
| 47 | Calculation and design of heat supply systems | The discipline studies calculations of heat supply systems, heat exchange devices, heat points, as well as steam and hot water boilers. The issues of designing heat supply systems using traditional energy sources, passive solar heating systems of buildings, active solar heat supply systems, geothermal heat supply systems, wind power plants, heat accumulators, biogas plants, gas supply systems are considered | 5 | | | | | | | | | | | v | | | | v | |
| 48 | Systems of production and distribution of energy carriers of industrial enterprises | The acquisition of students' skills in choosing rational schemes for the production and distribution of compressed air, cold, air separation products, fuel, design, calculate, select and operate the main and auxiliary equipment of these systems with the use of computer technology. | 5 | | | | | | | | | | v | | v | | | | |
| 49 | Thermal machines and GTU | Students in the course of studying the discipline should acquire the knowledge and skills necessary for a free orientation in the practice of operating superchargers in production. The main cycles of heat engines are considered - Carno, Renkin, Brighton, etc. The main attention is paid to the production of energy based on gas turbines. | 4 | | | | | | | | | | v | | | | | | |

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| 50 | Technology for the production of higt-potential steam in thermal power plants | Technological scheme of a steam boiler. Combined power plants. Technical characteristics of fuels and the efficiency of their use in the boiler. Combustion of gaseous, liquid fuel. The gorenje of a pulverized coal torch in the furnaces of steam generators. Heat exchange in boiler units. Thermal calculation and layout of steam boilers. The design of steam boilers. Energy steam boilers. Hydrodynamics of closed, open hydraulic systems. Environmental problems of fuel combustion | 6 | | | | v | | | | | v | | | | | | | |
| 51 | Heat production technology in industry | The discipline studies the main equipment involved in the production of thermal energy. Students will get acquainted with the principles of operation of boiler houses, heating networks, heating points | 6 | | | | v | | | | | v | | | | | | | |
| 52 | Operation of thermal power plants | The discipline studies the basics of operation of heat engineering equipment, in particular steam boilers, turbines, turbine condensers. The composition, functional purpose and interaction of individual parts of power systems are consistently considered; load schedules and basic operational indicators; organization of operation of power equipment; operational personnel; tasks, organization and planning of repairs; features of operation of specific power plants | 5 | | v | | | | v | | | | | | | | | | |
| 53 | Electrotechnical and thermotechnical measurements | The discipline "Electrical and heat engineering measurements" is a core subject, where students receive basic knowledge of the theory, device, as well as their graphical designation according to state standards and a single system of design documents (ESKD). They also gain knowledge of metrology, the classification of measurements and their errors, methods for measuring various electrical and heat engineering quantities. | 5 | | | | | v | v | | | | | | | | | | |

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| 54 | Power supply of enterprises | The discipline studies the issues of supplying enterprises with all types of energy necessary to fulfill the production plans of enterprises and are obtained from both local and district power supply installations. | 5 | | | | | | | | | | | v | | | | | | |
| 55 | Nuclear power plants | Nuclear power plants course consists of several parts: Fundamentals of nuclear physics and theoretical elements of a nuclear reactor, Physical processes, the reactor core, The structure of the technological circuit of nuclear power plants and reactors, heat transfer principles of reactor, reactor control and radiation safety. | 5 | | | | | | | | | | v | | | | | | | |

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

# WORKING CURRICULUM

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|---|---|
| Academic year | **2025-2026 (Autumn, Spring)** |
| Group of educational programs | **B062 - "Electrical engineering and energy"** |
| Educational program | **6B07122 - "Heat power engineering"** |
| The awarded academic degree | **Bachelor of engineering and technology** |
| Form and duration of study | **full time (shortened after TVET) - 3 years** |

| Discipline code | Name of disciplines | Block | Cycle | Total ECTS credits | Total hours | lek/lab/pr Contact hours | in hours SIS (including TSIS) | Form of control | Allocation of face-to-face training based on courses and semesters | | | | | | Prerequisites |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1 course | | 2 course | | 3 course | | |
| | | | | | | | | | 1 sem | 2 sem | 3 sem | 4 sem | 5 sem | 6 sem | |
| **CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)** | | | | | | | | | | | | | | | |
| **M-2. Module of physical training** | | | | | | | | | | | | | | | |
| KFK103 | Physical culture III | | GED, RC | 2 | 60 | 0/0/30 | 30 | E | 2 | | | | | | |
| KFK104 | Physical culture IV | | GED, RC | 2 | 60 | 0/0/30 | 30 | E | | 2 | | | | | |
| **M-3. Module of information technology** | | | | | | | | | | | | | | | |
| CSE677 | Information and communication technology | | GED, RC | 5 | 150 | 30/15/0 | 105 | E | | 5 | | | | | |
| **M-4. Module of socio-cultural development** | | | | | | | | | | | | | | | |
| HUM137 | History of Kazakhstan | | GED, RC | 5 | 150 | 15/0/30 | 105 | GE | 5 | | | | | | |
| HUM134 | Module of socio-political knowledge (cultural studies, psychology) | | GED, RC | 5 | 150 | 30/0/15 | 105 | E | 5 | | | | | | |
| HUM132 | Philosophy | | GED, RC | 5 | 150 | 15/0/30 | 105 | E | | 5 | | | | | |
| HUM120 | Module of socio-political knowledge (sociology, political science) | | GED, RC | 3 | 90 | 15/0/15 | 60 | E | | 3 | | | | | |
| **M-5. Module of anti-corruption culture, ecology and life safety base** | | | | | | | | | | | | | | | |
| HUM136 | Fundamentals of anti-corruption culture and law | 1 | GED, CCH | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| MNG489 | Fundamentals of economics and entrepreneurship | 1 | GED, CCH | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| PET519 | Fundamentals of scientific research methods | 1 | GED, CCH | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| CHE656 | Ecology and life safety | 1 | GED, CCH | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| MNG564 | Basics of Financial Literacy | 1 | GED, CCH | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| **CYCLE OF BASIC DISCIPLINES (BD)** | | | | | | | | | | | | | | | |
| **M-6. Module of physical and mathematical training** | | | | | | | | | | | | | | | |
| MAT103 | Mathematics III | | BD, UC | 5 | 150 | 15/0/30 | 105 | E | 5 | | | | | | MAT102 |
| **M-7. Module of basic training of special disciplines in heat power engineering** | | | | | | | | | | | | | | | |
| ERG153 | Engineering Thermodynamics | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | 5 | | | | | | PHY112 |
| ERG566 | Electrical and Electronic Engineering | | BD, UC | 6 | 180 | 30/0/30 | 120 | E | 6 | | | | | | |
| ERG576 | Thermodynamic cycles of heat engines and cooling processes | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | 5 | | | | | | |
| ERG577 | Solar installations and heat pumps | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | 5 | | | | | | |
| ERG567 | Boiler Plants and Steam Generators | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | | 5 | | | | | |
| ERG401 | Energy conversation in heat power and heat engineering | | BD, UC | 5 | 150 | 15/15/15 | 105 | E | | 5 | | | | | |
| ERG536 | Renewable energy | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | | | 5 | | | | ERG104 |
| ERG547 | Industrial Energy Audit and Energy-Saving | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | | | 5 | | | | |
| ERG544 | Thermal engineering measurements and control | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | | | 5 | | | | |
| ERG568 | Blowers and temple engines | | BD, UC | 4 | 120 | 30/0/15 | 75 | E | | | 4 | | | | |

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| ERG150 | Heat and Mass Exchange Equipment in Industrial Heat Power Engineering | | BD, UC | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| ERG594 | Heating and heating networks | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| ERG579 | Heat Supply Systems of Plant Facilities | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| MNG562 | Legal regulation of intellectual property | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| ERG433 | Transition processes in energy systems | 2 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | ELC163 |
| ERG533 | Fundamentals of the theory of fuel combustion and the combustion device | 2 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| CSE831 | Fundamentals of Artificial Intelligence | 2 | BD, CCH | 5 | 150 | 15/0/30 | 105 | E | | | | 5 | | | |
| ERG580 | Industrial and domestic heat and power equipment | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | 5 | | |
| ERG425 | Hydrogasodynamics of media in heat power plants | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | 5 | | |
| MNG563 | Fundamentals of sustainable development and ESG projects in Kazakhstan | 1 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | 5 | | |
| ERG581 | Heating networks and heat supply systems of enterprises and housing and communal services | 2 | BD, CCH | 6 | 180 | 30/0/30 | 120 | E | | | | | 6 | | |
| ERG593 | Steam-gas and gas-turbine facilities for heat and nuclear power plants II | 2 | BD, CCH | 6 | 180 | 30/0/30 | 120 | E | | | | | 6 | | |
| ERG559 | Main Machinery Operation of Heat Power Plant | 3 | BD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | 5 | | |
| ERG560 | Modeling in power systems | 3 | BD, CCH | 5 | 150 | 15/30/0 | 105 | E | | | | | 5 | | |
| **CYCLE OF PROFILE DISCIPLINES (PD)** | | | | | | | | | | | | | | | |
| **M-8. Module of professional disciplines in heat power engineering** | | | | | | | | | | | | | | | |
| AAP102 | Production practice I | | PD, UC | 2 | | | | R | | 2 | | | | | |
| ERG569 | Environmental Issues in Heat Power Engineering | | PD, UC | 5 | 150 | 30/0/15 | 105 | E | | | 5 | | | | |
| ERG542 | Steam turbines Heat power plants and nuclear power plants | | PD, UC | 5 | 150 | 30/0/15 | 105 | E | | | 5 | | | | |
| ERG571 | Accumulation of electric and thermal energy | | PD, UC | 4 | 120 | 30/0/15 | 75 | E | | | | 4 | | | |
| AAP183 | Production practice II | | PD, UC | 3 | | | | R | | | | 3 | | | |
| ERG582 | Electrotechnical and thermotechnical measurements | 1 | PD, CCH | 5 | 150 | 30/15/0 | 105 | E | | | | 5 | | | |
| ERG121 | Fundamentals of heat transformation and cooling processes | 1 | PD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | 5 | | | |
| ERG592 | Steam-gas and gas-turbine facilities for heat and nuclear power plants I | 2 | PD, CCH | 4 | 120 | 30/0/15 | 75 | E | | | | 4 | | | |
| ERG586 | Thermal machines and GTU | 2 | PD, CCH | 4 | 120 | 30/0/15 | 75 | E | | | | 4 | | | |
| ERG570 | Water Treatment | | PD, UC | 6 | 180 | 30/0/30 | 120 | E | | | | | 6 | | |
| ERG563 | Power and electrotechnical equimpment | | PD, UC | 4 | 120 | 30/0/15 | 75 | E | | | | | 4 | | |
| ERG587 | Heat production technology in industry | 1 | PD, CCH | 6 | 180 | 30/0/30 | 135 | E | | | | | 6 | | |
| ERG602 | Technology for the production of higt-potential steam in thermal power plants | 1 | PD, CCH | 6 | 180 | 30/0/30 | 120 | E | | | | | 6 | | |
| ERG134 | Operation of thermal power plants | 2 | PD, CCH | 5 | 150 | 30/15/0 | 105 | E | | | | | 5 | | |
| ERG111 | Sources and Systems of Heat Supply of Plant Facilities and Housing | 2 | PD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | 5 | | |
| ERG589 | Calculation and design of heat supply systems | 1 | PD, CCH | 5 | 150 | 30/0/15 | 105 | C | | | | | | 5 | |
| ERG590 | Calculation and design of combined cycle plants | 1 | PD, CCH | 5 | 150 | 30/0/15 | 105 | C | | | | | | 5 | |
| ERG572 | Nuclear power plants | 2 | PD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | | 5 | |
| ERG573 | Power supply of enterprises | 2 | PD, CCH | 5 | 150 | 15/15/15 | 105 | E | | | | | | 5 | |
| ERG574 | Systems of production and distribution of energy carriers of industrial enterprises | 3 | PD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | | 5 | |
| ERG575 | High-temperature processes and installations | 3 | PD, CCH | 5 | 150 | 30/0/15 | 105 | E | | | | | | 5 | |
| **M-9. Module of final attestation** | | | | | | | | | | | | | | | |
| ECA103 | Final examination | | FA | 8 | | | | | | | | | | 8 | |

| Additional type of training (ATT) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AAP500 | Military training | | | | | | | | | | | | | | | |
| **Total based on UNIVERSITY:** | | | | | | | | | 33 | 32 | 29 | 31 | 37 | 23 | | |
| | | | | | | | | | **65** | | **60** | | **60** | | | |

**Number of credits for the entire period of study**

| Cycle code | Cycles of disciplines | Credits | | | |
|---|---|---|---|---|---|
| | | Required component (RC) | University component (UC) | Component of choice (CCH) | Total |
| GED | Cycle of general education disciplines | 27 | 0 | 5 | 32 |
| BD | Cycle of basic disciplines | 0 | 50 | 31 | 81 |
| PD | Cycle of profile disciplines | 0 | 29 | 35 | 64 |
| **Total for theoretical training:** | | **27** | **79** | **71** | **177** |
| FA | Final attestation | | | | 8 |
| **TOTAL:** | | | | | **185** |

**Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024**

**Decision of the Academic Council of the Institute. Minutes № 3 dated 19.12.2024**

**Signed:**

| | |
|---|---|
| Governing Board member - Vice-Rector for Academic Affairs | Uskenbayeva R. K. |
| **Approved:** | |
| Vice Provost on academic development | Kalpeyeva Z. Б. |
| Head of Department - Department of Educational Program Management and Academic-Methodological Work | Zhumagaliyeva A. S. |
| Director of the Institute - A.Burkitbaev Institute of Energy and Mechanical Engineering | Yelemesov K. . |
| Department Chair - Power Engineering | Sarsenbayev Y. . |
| Representative of the Academic Committee from Employers ____Acknowledged____ | Abdykalykov G. Y. |