CATALOG OF ELECTIVE DISCIPLINES

6B07 - Engineering, Manufacturing and Civil engineering
(Code and classification of the field of education)

6B071 - Engineering and engineering trades
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

B062 - Electrical engineering and power engineering
(Code and classification of the educational program group)

6B07103 - Power Engineering
(Code and name of the educational program)

bachelor
(Level of preparation)

set of 2023

Semey 2023

Developed
By the Academic Committee of the OP
The head of the AK Nurymkhan Gulnur
OP Manager Khazhidinova Akbota

Reviewed
At the meeting of the Quality Assurance Commission of the
Faculty of Engineering and Technology
Recommended for approval by the Academic Council of the University
Protocol № 4/6 "10" April 2023
Chairman of the Commission on Quality Assurance Abdilova G.B.

Approved
at the meeting of the Academic Council of the University
Protocol №5 "21" April 2023
Chairman of the Academic Council Oralkanova Indira

Introduction to the specialty

Discipline cycle	Basic disciplines
Course	1
Credits count	3
Knowledge control form	Examination

Short description of discipline
This discipline introduces students to the Law on Education and Science of the Republic of Kazakhstan, the structure of higher education. Studying this course, the student receives the first concept of the educational program Thermal power engineering, namely: the Law on Energy Saving, energy in the national economy, energy resources, fuel, basic equipment of thermal power systems, non-traditional renewable energy sources, thermal and nuclear power plants, boiler plants, nuclear energy.

Purpose of studying of the discipline
The study of the discipline «Introduction to the specialty» is necessary to familiarize students with their future profession and encourage them to master the necessary knowledge and skills, as well as to familiarize students with the specifics of university education and the graduating department.

Learning Outcomes
ON4 To apply in educational, scientific and professional activities the requirements for the graduate of the educational program of the rules, requirements and norms for the preparation of documentation.

Learning outcomes by discipline
- describe the general characteristics of the educational program, the role of energy in the development of the economy, the requirements for a graduate in modern conditions.
- use the acquired knowledge in the process of mastering the disciplines of the educational program.
- perform various types of independent work.

Prerequisites
School course

Postrequisites
Thermodynamic fundamentals cycles of thermal power plants

The history of the development of thermal power engineering

Discipline cycle	Basic disciplines
Course	1
Credits count	3
Knowledge control form	Examination

Short description of discipline
This course describes in detail the methodology of the historical foundations of the development of technology and science. The questions about the need for the emergence of qualitatively new technical objects with their historical and technical prerequisites are summarized. The following are studied in more detail: thermal power facilities and installations, turbines of steam engines, cycles of steam power plants, internal combustion engines, gas turbine plants, nuclear- heat power and refrigeration plants.

Purpose of studying of the discipline
The acquisition by students of knowledge about the future profession, the dynamics of its development and prospects for the future. Professional orientation of the student, developing an understanding of the importance of the profession and the high importance of energy as a strategic industry, on which not only the economic well-being of the country, but its political position in the world depends.

Learning Outcomes
ON4 To apply in educational, scientific and professional activities the requirements for the graduate of the educational program of the rules, requirements and norms for the preparation of documentation.

Learning outcomes by discipline
- to determine the main patterns of development of the historical process in terms of thermal power engineering.
- study and independently analyze socio-political and scientific literature.
- apply the skills of a written reasoned presentation of one`s own point of view.

Prerequisites
School course

Postrequisites
Thermodynamic fundamentals cycles of thermal power plants

Fundamentals of thermal power engineering

Discipline cycle	Basic disciplines
Course	1
Credits count	3
Knowledge control form	Examination

Short description of discipline
The discipline forms students` concepts of the fuel and energy complex of the Republic of Kazakhstan with its features. Introduces the basics of combined production of electricity and thermal energy, thermodynamic cycles and schemes of power plants. The course is also devoted to the study of heat transfer issues, sources of heat production in district heating, alternative energy, prospects for the development of nuclear energy, the use of fuel and methods of its combustion.

Purpose of studying of the discipline
The purpose of the discipline is to prepare students to study the basic heat and power terminology and definitions, to show the importance and seriousness of the future specialty, to awaken interest in the chosen profession and the desire to work thoughtfully on its development.

Learning Outcomes

ON4 To apply in educational, scientific and professional activities the requirements for the graduate of the educational program of the rules, requirements and norms for the preparation of documentation.

Learning outcomes by discipline

- to solve the set tasks in conjunction with the analysis of the operation of thermal power facilities.
- perform basic thermal calculations.
- demonstrate basic knowledge in the field of fundamentals of thermal power engineering.

Prerequisites

School course

Postrequisites

Thermodynamic fundamentals cycles of thermal power plants

Theoretical foundations of electrical engineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course belongs to the engineering disciplines. The main questions of the theory of linear electrical and non-linear electrical circuits, methods for calculating currents, voltages under constant and other influences are considered. Theories of digital, analog and analytical signals and their conversion, generalized formulas for methods for calculating transients, three- phase electrical circuits and their calculation, basic provisions about electric motors are also considered.

Purpose of studying of the discipline

The purpose of studying the discipline is to teach students to apply the laws of electromagnetism and the theory of electrical circuits for the correct mathematical description and theoretical study of the processes occurring in various electrical devices and complex systems.

Learning Outcomes

ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline

- apply the laws of electrical circuits of direct, sinusoidal and non-sinusoidal current.
- use the basic methods for calculating transient processes in electrical circuits.
- own methods of calculation of electric motors and electric drives.

Prerequisites

Physics

Postrequisites

Thermal and nuclear power stations

Electrical engineering and electronics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course of discipline consists of two sections: electrical engineering and electronics. The study of the discipline is based on the theory and practical application of linear, non- linear electrical circuits of direct and alternating current, electrical signals, electrical devices and measurements, the basics of digital electronics in modern production processes and control systems. Various physical quantities characterizing electromagnetic phenomena are also considered.

Purpose of studying of the discipline

The purpose of mastering the discipline is to study by students the basic patterns of processes occurring in electromagnetic and electronic circuits and methods for determining electrical quantities that characterize these processes, the acquisition of theoretical and practical knowledge on the basics of electrical engineering and electronics, necessary for the successful development of subsequent disciplines of the specialty.

Learning Outcomes

ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline

1) be able to experimentally determine the parameters and characteristics of typical electrical devices and equipment;
2) apply the skills of measuring basic electrical quantities and some non-electrical quantities associated with the profile of engineering activities;
3) use electrical devices, devices and machines, manage them, as well as gain the skills of their effective and safe control.

Prerequisites

Physics

Postrequisites

Thermal and nuclear power stations

Electrical engineering, electronics and electric drive

Discipline cycle	Basic disciplines
Course	2
Credits count	5

Knowledge control form	Examination

Short description of discipline
In this course of the discipline, the main issues related to the study of magnetic and electrical circuits are considered. Describes digital elements and devices, methods of synthesis and analysis of electronic circuits, electrical instruments and measurements, electronic devices and instruments, as well as electric motors and apparatus. The constructions and principles of operation of electric machines of direct and alternating currents are considered.

Purpose of studying of the discipline
Formation of the ability to use the basic laws and laws of electrical engineering, electronics, and electric drive. Master the methods of calculating and studying the characteristics of electrical circuits, electrical machines, electronic devices, skills in using reference literature, selecting and operating electrical, electromechanical and electronic devices.

Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline
- know the basic electrical laws, their practical application; principle of operation, device, properties, applications and potentialities of the main electrical, electronic, electromechanical devices, electric drive.
- use the skills necessary for measuring electrical quantities devices; collect electrical circuits with electrical and electronic devices, connect them to the mains, experimentally determine the parameters and characteristics; calculate electrical and electronic circuits, electrical machines, their parameters and characteristics.
- apply basic knowledge in the field of reading and drawing up control schemes for electrical devices.

Prerequisites
Physics

Postrequisites
Thermal and nuclear power stations

Theoretical basics of heat engineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline is devoted to the study of the basic laws of thermodynamics and heat and mass transfer. The basic concepts and definitions are considered as: thermal parameters, ideal and real gases, thermodynamic process, water and steam, parameters of the working fluid, thermal radiation, heat transfer, heat transfer, thermal conductivity, convection, similarity theory, Fourier and Newton-Richmann laws, as well as heat exchangers and thermodynamic cycles of processes and installations.

Purpose of studying of the discipline
The purpose of the course is to give students extensive knowledge about the basic principles and laws of thermodynamics, modern methods for analyzing and calculating thermodynamic processes and cycles of thermal power plants, about fundamental laws and methods for analyzing and calculating heat and mass transfer processes, to develop practical skills in determining the characteristics of heat and mass transfer processes of heat power and heat technology installations and systems

Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline
- to determine the thermodynamic properties of pure substances and their mixtures.
- describe phase equilibrium and phase transitions.
- use the first and second laws of thermodynamics.

Prerequisites
Physics

Postrequisites
Heat and mass transfer

Heat engineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline «Heat engineering» is aimed at studying the main sections of thermodynamics and heat and mass transfer. The following are presented for study: laws of thermodynamics, thermodynamic processes, the concept of "moist air" and "thermodynamic diagram", gas mixtures and the laws of ideal gases, methods of heat transfer (thermal conduction, convection, thermal radiation), heat transfer, heat and energy, similarity theory, classification and cycles of heat engines , features of the theory of fuel combustion (solid, liquid, gaseous).

Purpose of studying of the discipline
The purpose of the discipline «Heat engineering» is the development by students of the fundamental laws of thermodynamics and heat transfer, the mutual transformation of heat and work, the study of the theory of heat engines, refrigeration machines and steam generators, as well as its practical applications in solving problems of heat power engineering.

Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline
- apply the basic laws of energy conversion, the laws of thermodynamics and heat and mass transfer.
- describe thermodynamic processes and cycles, the main properties of working fluids, the principle of operation and the design of heat exchangers, heat power plants and other heat technology devices.
- carry out standard heat engineering calculations of structures and modes of operation of thermal machines.
Prerequisites
Physics
Postrequisites
Heat and mass transfer

Thermodynamics and heat transfer

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course of the discipline outlines the basics of technical thermodynamics and heat transfer. The basic concepts and definitions in the study of the discipline include: thermodynamic processes, thermodynamic diagrams and tables, thermal conductivity - stationary, non-stationary and their processes, heat transfer, convection, fluid flow, heat transfer, heat exchangers and installations. Methods for calculating thermodynamic processes and cycles of heat power and refrigeration plants are presented.
Purpose of studying of the discipline
The purpose of teaching the discipline is: the development of the basic laws of thermodynamics, the study of thermodynamic processes of reversible and irreversible stationary and non-stationary. Basic thermodynamic processes in ideal gases. The study of thermodynamic cycles of various processes and systems, principles of operation and design features of heat and steam generators, heat transformers, refrigerators and refrigerators, heat exchangers and devices, heat and mass transfer processes occurring in various types of thermal installations.
Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.
Learning outcomes by discipline
- perform thermodynamic calculation of heat power devices and equipment.
- know the basics of heat engineering, the procedure for calculating thermal conductivity, heat transfer, heat transfer.
- use the methods of mathematical modeling to describe the processes of thermodynamics and heat transfer.
Prerequisites
Physics
Postrequisites
Heat and mass transfer

Computer technologies in thermal power engineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course «Computer technologies in thermal power engineering» is aimed at studying methods for modeling thermal engineering, thermal power processes, systems and installations using computer technology. Methods of mathematical, physical modeling of processes and systems of heat power and heat technology objects are studied, which are accompanied by a computational experiment. The use of computer technology (software products) and computer technology to select acceptable options for systems and installations of heat power.
Purpose of studying of the discipline
Formation of the student`s knowledge, abilities and skills in the use of computer technology in the calculations of heat and power processes, as well as the use of modern computer-aided design systems in heat and power processes.
Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.
Learning outcomes by discipline
- use the basic algorithms for the implementation of numerical methods.
- apply mathematical packages of applied programs.
- own the means and techniques of working with the mathematical editor of the MathCAD, MATLAB and AutoCAD systems.
Prerequisites
Application of USDD standards in the design of engineering documentation.
Postrequisites
Final examination

Elements of machine graphics and CAD basics in thermal power engineering

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
Studying the discipline «Elements of computer graphics and CAD in power bases», the student develops knowledge and skills of the basics of engineering design. Modern methods of building computer-aided design systems for power facilities and installations are being studied. Practical skills are characterized by the use of a number of software packages MathCAD, MathLab and AutoCAD, for performing technical calculations and modeling heat power facilities.
Purpose of studying of the discipline
Formation of the student`s knowledge, abilities and skills in the use of modern computer-aided design systems in heat and power processes
Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.
Learning outcomes by discipline
- own mathematical packages of applied programs.
- use the tools and techniques of working with the graphic editor of the AutoCAD system.
- apply the tools and techniques of working with the mathematical editor of the MathCAD system, MathLab.
Prerequisites
Application of USDD standards in the design of engineering documentation.
Postrequisites
Final examination

Heat and mass transfer

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline is aimed at studying the basic concepts of heat and mass transfer and considering the physical meaning of the processes of mass and heat transfer in space and time. The issues of stationary and non-stationary heat conduction, heat transfer by radiation, convective heat transfer, similarity of heat transfer phenomena, heat transfer processes during phase transformations, liquid and gaseous media, the law of conservation of mass and energy are studied. Thermal calculations of heat exchangers are made.
Purpose of studying of the discipline
The purpose of the discipline is to master the methods for performing calculations of the main processes of heat and mass transfer: heat conduction in structural elements, heat and mass transfer with free and forced convection, two-phase heat and mass transfer, radiative heat and mass transfer, learn how to calculate heat and mass transfer apparatuses and apply heat transfer intensification methods.
Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.
Learning outcomes by discipline
- describe the phenomena of transfer of momentum, heat and mass.
- use the basic laws of heat and mass transfer.
- to determine the heat transfer coefficients for natural and forced fluid motions, as well as for phase transitions.
Prerequisites
Theoretical basics of heat engineering
Postrequisites
Air conditioning and refrigeration

Heat and mass transfer processes and apparatuses thermotehnologi

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is devoted to familiarizing students with heat technology devices, processes and systems. Ideas about the processes of mass and heat transfer during heat transfer, as well as during drying, rectification and evaporation. Performing calculations of heat and mass transfer processes and devices for industrial use. Mathematical models of heat and mass transfer processes of heat-technological and heat-engineering devices and installations, models of flow and heat transfer in devices and drying chambers are studied.
Purpose of studying of the discipline
The purpose of this discipline is to study the physical processes and principles of operation of various types of heat exchange, evaporator, drying, refrigeration and other heat and mass transfer equipment used in the energy sector of a modern industrial enterprise, methods for their calculation and design, characteristic modes and technical and economic indicators of their work.
Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.
Learning outcomes by discipline
- to know the main patterns of heat and mass transfer processes and the quantities characterizing these processes.
- be able to determine the thermophysical characteristics of substances.
- have skills in thermal calculation of heat exchange equipment.
Prerequisites
Theoretical basics of heat engineering

Postrequisites
Air conditioning and refrigeration

Heat and mass transfer in power plants

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The main sections studying the physical foundations of the processes of mass and heat transfer are presented for the study of the discipline, the basics of heat transfer are outlined: the processes of stationary and non-stationary heat conduction, convective heat transfer, diffusion, boiling, condensation, heat transfer by radiation. The features of heat transfer processes under different operating modes of power plants are considered. It also outlines the principles of engineering methods for thermal and hydraulic calculations of power and nuclear installations, heat exchangers, steam generators.

Purpose of studying of the discipline
The purpose of the discipline is to study the processes of heat and mass transfer occurring in the elements of modern heat and power devices and installations. Substantiation of the choice of optimal operating modes and design of heat engineering devices.

Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline
- know the thermal processes occurring in devices for the conversion and use of energy.
- perform calculations of heat and mass transfer equipment, select standard and auxiliary equipment based on calculations.
- have the skills to select working fluids, heat generating and heat-using equipment, heat-insulating materials, methods for intensifying heat and mass transfer processes.

Prerequisites
Theoretical basics of heat engineering

Postrequisites
Air conditioning and refrigeration

Technical thermodynamics

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
When studying this discipline, the basic laws of thermodynamic processes and systems are considered. The basic concepts of technical thermodynamics, the laws and methods of thermodynamics, the conditions of thermodynamic equilibrium, phase transformations, the cycles of gas turbine, steam turbine installations of thermal and nuclear power plants, as well as the cycles of refrigeration machines are described. The main thermodynamic processes of ideal and real gases, their graphic representation in T-s, h-s diagrams are considered.

Purpose of studying of the discipline
Training of specialists in the field of application of thermodynamic methods for the analysis of physical and chemical phenomena, modern methods of analysis and calculation of thermodynamic processes and cycles

Learning Outcomes
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline
- know the basic laws of thermodynamics, direct and reverse cycles.
- apply the basic principles of technical thermodynamics for the analysis of physical and chemical processes, tables and diagrams of the state of substances in the analysis of processes and cycles.
- use the skills of working with diagrams when performing energy calculations and calculations of thermodynamic processes and cycles.

Prerequisites
Introduction to the specialty

Postrequisites
Heat pumps

Thermal energy systems and energy use

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is devoted to the study of the main issues of production of thermal and electrical energy, thermal power schemes for various purposes, systems for the production and distribution of energy carriers of industrial enterprises. The main energy characteristics of material and thermal balances of heat technological processes and installations are given. Heat supply systems are described. The problems and prospects for the development of the country`s energy sector and its components are reflected. Particular attention is paid to the issues of energy saving and energy efficiency of processes and industries.

Purpose of studying of the discipline
The purpose of studying the discipline is to form students` ideas about the current state and prospects for the development of the main

heat and power processes and systems; In studying the essence of physical processes occurring in heat and power systems and mastering the methods of heat engineering calculations. Design of industrial heat and power systems, evaluation of the effectiveness of energy and energy saving programs.

Learning Outcomes

ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline

- know the structure of thermal power plants; structure and general principles of functioning of heat and power systems of industrial enterprises.
- choose the main and auxiliary equipment of heat sources and heat supply systems; analyze the processes taking place in heat engineering installations.
- have the skills to calculate the energy performance of TPPs; methods for calculating the energy characteristics of heat engineering industries.

Prerequisites

Introduction to the specialty

Postrequisites

Heat pumps

Thermodynamic fundamentals cycles of thermal power plants

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This discipline is aimed at studying the basics of thermodynamics. Application of the laws of thermodynamics for the calculation of processes and cycles of thermal power plants. The thermodynamic properties of substances and working fluids such as ideal and real gases, water vapor are described. Reference and tabular data on the thermodynamic properties of these substances are given. The thermodynamic cycles of power plants are considered: gas-turbine, steam-turbine and combined-cycle.

Purpose of studying of the discipline

The purpose of the discipline is: the study of the laws of conservation and transformation of energy, in relation to systems of transfer and transformation of heat. Studying the basics of thermodynamic analysis of work processes in heat-power, heat-pump and refrigeration machines and methods for analyzing their energy efficiency.

Learning Outcomes

ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline

- describe the laws of conservation and transformation of energy in relation to systems of transfer and transformation of heat.
- calculate thermodynamic processes and cycles; explains the main properties of working bodies.
- to state the basics of the theory of thermodynamic cycles; considers the main methods and techniques of analysis.

Prerequisites

Introduction to the specialty

Postrequisites

Heat pumps

Special questions fuel combustion

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course is aimed at studying the thermal characteristics of fossil fuels, as well as methods of preparing fuel for combustion in boiler furnaces. The main technological schemes and the design of the elements of the fuel preparation and fuel supply system are studied. Methods for determining the heat balance of a boiler unit are considered. The description of the main methods of burning solid fuel and the design of burners in thermal power plants is given.

Purpose of studying of the discipline

Training of specialists in the field of fuel combustion methods in the furnaces of power boilers of industrial enterprises, familiarization with modern methods of burning gaseous, liquid and solid fuels with maximum efficiency, selection and calculation of combustible devices depending on the type and characteristics of combustible fuel.

Learning Outcomes

ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.

Learning outcomes by discipline

- tell the composition of the fuel, the characteristics of the fuel.
- describe the kinetics of chemical reactions of combustion.
- explain methods of fuel combustion.

Prerequisites

Theoretical basics of heat engineering

Postrequisites

Energy saving in heat power engineering and heat technology

Gas turbines and GTP

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course discusses the basic concepts of gas turbine installations operating at thermal power plants. The description of the basic scheme and principles of operation of gas turbine plants is given. Operating modes and basic structural elements are studied gas turbine plants related to the main equipment of thermal power plants. The determination of the main parameters and modes of gas turbine plants is being studied. Attention is paid to thermal and strength calculations of heat engines.

Purpose of studying of the discipline
The purpose of studying the discipline is to study the fundamentals of the theory of gas turbine installations, the features of their designs and the composition of thermal circuits. Analysis of methods for increasing the efficiency of gas turbine installations.

Learning Outcomes
ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.

Learning outcomes by discipline
- to use the theoretical foundations of work processes in the elements of gas turbines.
- analyze the operation of the GTP.
- to apply the received information in the design of elements of thermal circuits of power plants.

Prerequisites
Theoretical basics of heat engineering

Postrequisites
Energy saving in heat power engineering and heat technology

Industrial heat and mass transfer processes and installation

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The course of discipline «Industrial heat, mass transfer processes and installation» considers the basics of heat, mass transfer processes, apparatus and installations. Also, processes occurring in industrial equipment and installations of various types and purposes. Classifications and descriptions of apparatus and installation designs are presented. The basics of design and calculation of devices and installations of the technological industry, as well as an assessment of their technical and economic indicators are given.

Purpose of studying of the discipline
The study of physical processes and principles of operation of various types of heat exchange, evaporator, distillation, drying, refrigeration and other heat and mass transfer equipment used in the energy sector of a modern industrial enterprise, methods for their calculation and design, characteristic modes and technical and economic indicators of their work.

Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.

Learning outcomes by discipline
- to know and read schemes, composition of equipment and modes of operation of modern and advanced industrial heat and mass transfer plants.
- perform thermal and hydraulic calculation of heat exchangers of various types based on existing methods.
- apply the information obtained in the design of heat exchange equipment.

Prerequisites
Heat and mass transfer

Postrequisites
Thermal mechanical and auxiliary equipment of power plants

Thermal and nuclear power stations

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
This course introduces various types of thermal and nuclear power plants and their purpose. Technologies for the production of thermal, electrical energy at thermal, nuclear power plants are being studied. Classification of power plants. Structural thermal diagrams of thermal, nuclear power plants are given. The adoption of technical decisions in the design and operation of power plants is considered and justified. Evaluation of technical and economic indicators of the efficiency of power plants.

Purpose of studying of the discipline
Formation of knowledge in the field of general principles, structure and functioning of thermal power plants and nuclear power plants, setting and solving problems of energy use in heat engineering production.

Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.

Learning outcomes by discipline
- explain the principles of constructing schemes of power plants.
- describe the main schemes of energy production and distribution systems.

- choose the main and auxiliary equipment of heat sources and heat supply systems.

Prerequisites

Heat and mass transfer

Postrequisites

Thermal mechanical and auxiliary equipment of power plants

Energye equipment NPI

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

The main content of the discipline is based on the study of types and designs of nuclear power plants. Devices, principles of operation of the main and auxiliary equipment of nuclear power plants are described. The basics of control systems and automation of nuclear power plants are given. Calculations are carried out for the design and selection of equipment, modeling of the processes of nuclear power plants. The issues of operation safety and efficiency of nuclear power plants are reflected.

Purpose of studying of the discipline

The purpose of the discipline «Energy equipment NEI» is to gain knowledge on the design, principles of operation and functional purpose of the main power equipment of nuclear power plants.

Learning Outcomes

ON10 Calculate and regulate energy production and distribution systems.

Learning outcomes by discipline

- describe the technological schemes of nuclear power plants.
- calculate steam and gas turbines.
- acquire computational skills in the field of power equipment of modern nuclear power plants (NPPs).

Prerequisites

Heat and mass transfer

Postrequisites

Thermal mechanical and auxiliary equipment of power plants

High temperature materials and coverings

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course discusses modern methods of obtaining high-temperature materials and coatings that improve their performance. The dependences of the mechanical properties of high-temperature materials and coatings on their microstructure are studied, the sections of physics devoted to the strength, plasticity and destruction of materials are studied. The methods of structural analysis of materials and new technologies of their construction, which are most widely used at the present time, are considered.

Purpose of studying of the discipline

The objectives of the discipline are aimed at acquaintance and study of new generation materials; obtaining new promising materials; structure and properties of materials used in the thermal power industry.

Learning Outcomes

ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline

- use the classification and scope of high-temperature materials and coatings.
- choose materials with the required quality.
- to determine the mechanical properties of materials.

Prerequisites

Heat and mass transfer

Postrequisites

Heat pumps

Air conditioning and refrigeration

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course examines the principles of creating and automatically maintaining the required values of humidity, temperature and air velocity in the premises, ensuring an optimal microclimate of air-conditioned rooms. The work of technical means of air extraction, filtration, humidification, heating, cooling and cleaning is described. The systematization of knowledge and skills in the field of air conditioning and refrigeration processes of industrial and residential premises is carried out.

Purpose of studying of the discipline

The purpose of studying the discipline is to acquire theoretical knowledge and practical skills in calculating, designing and operating modern air conditioning systems in buildings and structures for various purposes with minimal energy and environmental impact on the environment.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline

- describe the main elements of air conditioning systems.
- apply the basic provisions of the theory of air conditioning as the basis for making correct, reasonable and cost-effective technical solutions.
- use methods for calculating and determining the optimal parameters of air conditioning and refrigeration systems.

Prerequisites

Heat and mass transfer

Postrequisites

Heat pumps

Boiler installations and steam generators

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

The discipline is aimed at studying boiler plants and steam generators of thermal power plants. Information is provided on the main equipment of boiler plants, ways to improve their heat and power efficiency in general. The efficiency of heat exchange processes in solid fuel boiler elements is studied. The main processes of fuel preparation for boiler plants are described.
Thermal schemes are studied, as well as the characteristics and designs of boilers of thermal power plants.

Purpose of studying of the discipline

The purpose of studying the discipline is to acquire knowledge about the types and designs of steam, hot water and steam boilers, about the organization of combustion of organic fuels in boiler furnaces, about thermophysical and hydro-gas-dynamic processes occurring in the gas-air and steam-water paths of a boiler plant, about the operating conditions of heating surfaces.

Learning Outcomes

ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.

Learning outcomes by discipline

- describe the achievements of science and technology, best practices in the field of boiler building.
- to consider methods for conducting design and verification thermal calculation of a steam (hot water) boiler.
- explain the technological scheme of fuel combustion.

Prerequisites

Theoretical basics of heat engineering

Postrequisites

The thermal network

Installation and operation of heat and power equipment

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

This discipline describes the basic provisions of the installation and operation of thermal power equipment and systems. The performance indicators and functions of thermal power systems are considered. The description and features of maintenance of thermal power equipment of CHPP are given. The work of cogeneration turbines is studied according to thermal and electrical load curves, as well as the features of operation modes of turbines with backpressure, industrial and cogeneration controlled steam extractions.

Purpose of studying of the discipline

The purpose of the discipline is the study of the regulatory framework, materials, equipment and technology for the installation and operation of thermal power plants.

Learning Outcomes

ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.

Learning outcomes by discipline

- know the features of operation of CHP equipment, start-stop modes of TPP equipment, modes of operation of heat supply systems.
- to solve optimization problems for the distribution of loads between the parallel operating equipment of the TPP.
- to determine the costs of fuel, energy and material resources in installations and heat supply systems of industrial enterprises.

Prerequisites

Theoretical basics of heat engineering

Postrequisites

The thermal network

Power boilers and low-capacity boiler plants

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
This course deals with power boilers and low-capacity boiler plants used in industrial enterprises and thermal power plants. The main elements and designs of power boilers and low-capacity boiler plants are described. The efficiency of heat transfer processes in the heating surfaces of boiler units is studied. The description of thermal schemes of drum boilers with natural and forced circulation is given.
Purpose of studying of the discipline
The purpose of mastering the discipline: The study of structures, physical principles of operation, processes in gas and working environments, calculation and design, characteristics, basics of operation and industrial application of boiler plants.
Learning Outcomes
ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.
Learning outcomes by discipline
- apply new, highly efficient, environmentally friendly fuel combustion technologies.
- use higher quality and new materials in the manufacture of boilers.
- to increase the thermal efficiency of boiler plants by using the latent heat of vaporization with a decrease in the temperature of the flue gases.
Prerequisites
Theoretical basics of heat engineering
Postrequisites
The thermal network

Theoretical foundations of refrigeration technology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
Thermodynamic concepts, definitions and laws of the fundamentals of refrigeration engineering are given. The thermodynamic principles of operation of refrigerating machines and installations are stated. The physical phenomena and processes used to obtain low temperatures and the cooling effect are considered. The main thermodynamic processes, the classification of refrigerating machines and installations are studied. The problems of choosing rational methods for calculating and analyzing low-temperature thermodynamic cycles are solved.
Purpose of studying of the discipline
The purpose of mastering the discipline is to form and specify theoretical knowledge on the basics of obtaining low temperatures and to prepare future specialists for independent thermodynamic analysis and calculation of work processes in low-temperature installations.
Learning Outcomes
ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.
Learning outcomes by discipline
- apply various cooling systems, various schemes of refrigeration units.
- calculate, design and test elements of refrigeration units.
- use methods for calculating and designing thermal insulation of cooled objects.
Prerequisites
Thermodynamic fundamentals cycles of thermal power plants
Postrequisites
Superchargers and heat engines

Refrigeration technology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is aimed at studying the fundamental theories of refrigeration engineering, the basics of thermodynamics, methods of production and consumption of low temperatures, as well as artificial cold, direct, reversible and irreversible cycles, properties of cycles of refrigeration machines, installations and refrigerants. The choice and method of calculation of refrigeration equipment are substantiated. The methods of design, installation and technical operation of refrigerating machines and installations are given.
Purpose of studying of the discipline
The objectives of mastering the discipline are in-depth training in the field of processes and apparatus for the production of artificial cold, the formation of knowledge about the basics of thermodynamic calculation and analysis of the operation of refrigeration machines and their individual elements, the training of specialists for professional activities in the field of design and construction, operation and maintenance of low-temperature heat exchangers installations.
Learning Outcomes
ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.
Learning outcomes by discipline

-- apply various cooling systems, various schemes of refrigeration units.
- calculate, design and test elements of refrigeration units.
- use methods for calculating and designing thermal insulation of cooled objects.

Prerequisites

Thermodynamic fundamentals cycles of thermal power plants

Postrequisites

Superchargers and heat engines

Refrigeration machines

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The basis of this discipline is the devices and principles of operation of refrigeration machines. In the course of studying the discipline, the student must have knowledge about: the basics of thermodynamic work and the working substances of refrigeration machines, the types and classification of refrigeration machines, heat exchangers and the design of auxiliary equipment. Study images of circuit diagrams and thermal diagrams for refrigerants. Perform refrigerant cycle calculations.

Purpose of studying of the discipline

The purpose of mastering the discipline is to study and acquire practical skills in the design and calculation of refrigeration systems and installations from the conditions of reliability, safety, efficiency of their operation. Development of the ability to investigate and test refrigeration units and apparatuses in the process of their creation and operation, as well as the ability to analyze their activities and the information received. The study of the discipline provides for familiarization of students with the industrial production of artificial cold, its rational use for the implementation of technological processes and maintaining optimal temperatures in storage and refrigeration chambers.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON5 Use the fundamental laws of mechanics, thermodynamics and heat and mass transfer and their practical applications in solving problems of heat power engineering and heat technology.

Learning outcomes by discipline

- apply the physical foundations and equipment for obtaining and low temperatures.
- manage the parameters of technological processes.
- use rational methods of process control and operation of machines and devices.

Prerequisites

Thermodynamic fundamentals cycles of thermal power plants

Postrequisites

Superchargers and heat engines

Steam turbines

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

This discipline describes the purpose and principles of operation of steam turbine devices. The classification of steam turbines and turbogenerators, design features and their operation are considered. In mastering the discipline, students include methods for designing, operating and adjusting turbine equipment and their individual devices, methods for optimizing the operation mode of turbines, modeling processes and cycles in steam turbines.

Purpose of studying of the discipline

Formation of basic information on the entire range of issues related to the principle of operation of steam turbines, their varieties, the design of parts and assemblies of turbine plants and thermal processes occurring in them.

Learning Outcomes

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- determine the place of the steam turbine and turbine plant in the power unit of TPP and NPP.
- use ways to improve the efficiency and reliability of the turbine and the entire turbine plant.
- to determine the qualitative and quantitative indicators of the operation of the turbine and steam turbine plant.

Prerequisites

Theoretical and applied mechanics

Postrequisites

Final examination

The turbines of thermal and nuclear power stations

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The content of the discipline outlines the basic concepts of steam and gas turbines. Classifications and types of turbines, as well as features of their operation are given. Technologies and methods of energy conversion at thermal and nuclear power plants and their efficiency are considered. The values of principal thermal diagrams and thermal diagrams of power units are described. Methodical bases and examples of calculation of thermal and design calculation of turbines are given.
Purpose of studying of the discipline
The purpose of the discipline: Mastering the theory, designs, design practice, conditions and modes of operation of power turbomachines of thermal and nuclear power plants, understanding the relationship between the operation of steam and gas turbines and technological processes in the equipment of thermal circuits of power units for various purposes.
Learning Outcomes
ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.
Learning outcomes by discipline
- describe the cycles underlying the operation of steam turbines and gas turbine units of thermal power plants and nuclear power plants.
- show ways to improve the efficiency and reliability of the turbine and the entire turbine plant.
- use the method of heat and aerodynamic calculations of the stage and the entire turbine.
Prerequisites
Theoretical and applied mechanics
Postrequisites
Final examination

Design of turbine plants

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course is devoted to the study of the design of industrial turbine installations, their classification and principles of operation. The general rules for the design of turbine units and installations are considered, attention is paid to the choice of parameters of the working fluid, the main parts of turbines. The thermal calculation of the steam turbine is carried out. The degree of reactivity and its effect on the efficiency of the turbine plant, the output power of electric energy generation are studied.
Purpose of studying of the discipline
The purpose of mastering the discipline is to prepare the student to carry out design, research, operational, installation, commissioning and repair activities in the field of turbine installations of thermal and nuclear power plants.
Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.
Learning outcomes by discipline
- to determine methods for searching for optimal parameters and designs of turbine units.
- to use modern technologies when conducting research of processes in turbine plants.
- apply software in the design and calculations of turbine equipment.
Prerequisites
Thermodynamic fundamentals cycles of thermal power plants
Postrequisites
Final examination

Heat pumps

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course examines existing projects and prospects for the use of heat pumps in various sectors of the economy. Information is provided on the basic general principles of operation of heat pumps, ways to increase their energy efficiency. The possibilities of using heat pump installations in heat supply systems of large cities and regions are being studied. The description of concrete examples of implemented projects on the introduction of heat pumps in the production process is given.
Purpose of studying of the discipline
The purpose of mastering the discipline is the formation of knowledge, skills and abilities necessary in professional activities in the field of energy saving in technological processes of production carried out using heat pump installations. The study of the main designs of heat pumps, methods of calculation and design of heat pump installations used in thermal power engineering.
Learning Outcomes
ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.
Learning outcomes by discipline
- describe the main processes and the principle of operation of the equipment of heat pump installations.
- apply methods for calculating machines and devices of heat pump installations for given parameters and thermal loads.
- to formulate the basic concepts of theoretical and actual thermodynamic cycles of operation of heat pump installations.
- use methods of designing systems using heat pump installations.
- perform calculations of machines and devices of heat pump installations with given parameters and thermal loads for various technological and production processes.

- to present ways of intensifying processes and improving apparatuses of heat pump installations.
- to determine the optimal operating parameters of heat pump installations and ways to achieve them.
- use methodological and regulatory materials, specifications and standards for the calculation and design of heat pump installations.

Prerequisites
Thermodynamic fundamentals cycles of thermal power plants

Postrequisites
Final examination

Automation of turbine plants

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is aimed at studying the design and construction of steam turbines, the principle of their operation, automation of production processes of turbine units. Possible advantages and disadvantages of automation of auxiliary steam turbine installations are considered. The formulation and ways of solving the problem of building automated control systems of turbine units, approaches that provide reliable protection of the automation system of the turbine unit with minimal financial costs are determined.

Purpose of studying of the discipline
The objectives of mastering the discipline: the formation of students` skills and abilities in the operation of automation of the main equipment of thermal power plants; formation of knowledge about the forms of mathematical description of the steady-state operating modes of turbine plants, methods for setting initial information, algorithms for solving optimization problems

Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline
- use the principles of turbine plant automation.
- to determine and ensure efficient operation modes of turbine plants.
- to select means of accounting and automation of turbine installations.

Prerequisites
Electrical engineering and electronics

Postrequisites
Final examination

Automation of the power equipment of thermal and nuclear power plants

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course is aimed at studying control systems that perform the functions of automatic monitoring of current data of the operation of thermal power equipment, automatic sound signal about the state of the main and auxiliary equipment of power plants, automatic operation of equipment protection against possible damage during their operation. The possibilities of remote control of the technological process, switching on or off the regulators in a certain sequence, the feasibility of using automation in the operation of thermal power plants are considered.

Purpose of studying of the discipline
Formation of basic knowledge and skills in the field of automation of heat and power processes. Formation of knowledge by modern technical means of automation used for the introduction of technological processes of thermal and nuclear power plants, industrial enterprises. Work with automatic measurement control systems and their analysis.

Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline
- describe the modern principles of building automated production and process control systems.
- calculate the settings of control systems.
- optimize control systems.
- to design automation systems for thermal power plants.

Prerequisites
Electrical engineering and electronics

Postrequisites
Final examination

Hydraulic machine

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is devoted to the study of the basic laws of hydraulics, hydrodynamics, the laws and nature of the flow of liquids and gases.

The devices, structures, principles of operation and methods of operation of various hydraulic machines, hydraulic drives are considered. Methods for calculating and determining the main parameters and technological modes of operation of hydraulic machines are given. Descriptions of the principles of constructing mathematical and physical models of hydraulic processes are given.

Purpose of studying of the discipline

Formation of students` system of professional knowledge, skills and practical skills for highly efficient operation, quality service and further improvement of hydraulic machines and equipment used in the energy sector.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- know the classification of hydraulic machines and compressors, the purpose and scope of hydraulic machines and compressors.

- depict simplified schematic diagrams of hydraulic machines and compressors.

- explain the principle of operation of hydraulic machines and compressors.

Prerequisites

Fluid and gas mechanics

Postrequisites

Final examination

Compressors, fans and pumps

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course of the discipline is studied on the basis of knowledge of the basic laws of theoretical mechanics, fluid and gas mechanics, thermodynamics, heat and mass transfer. The discipline course consists of main sections that describe the types, principles of operation and elements of compressors, fans, pumps. Structural elements and technological parameters of superchargers are considered. Methods and examples for calculating compressors, pumps and fans are also given.

Purpose of studying of the discipline

The purpose of mastering the discipline is to prepare the student to carry out design, research, operational, installation, commissioning and repair activities in the field of pumps, fans and compressors used in thermal and nuclear power plants.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- describe the procedure for constructing the characteristics of the system in parallel, sequentially operating superchargers.

- to determine the operating mode of each fan is carried out by construction, opposite to the construction of the total characteristic.

- determine the effective power of the compressor drive and the required power of the electric motor.

Prerequisites

Fluid and gas mechanics

Postrequisites

Final examination

Superchargers and heat engines

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline contains a description of the main types, designs and principles of operation of various types of superchargers and heat engines. Carrying out thermal, hydraulic and structural calculations of superchargers and heat engines. The study of the discipline also includes the concepts of efficiency of thermal engines, the issues of the basics of calculation and the principles of operation of steam and gas turbines, internal combustion engines, compressors, fans, pumps are considered.

Purpose of studying of the discipline

Study of the theoretical and technical foundations of the operation of various types of blowers and heat engines used in the heat and power industry, the features of their operation, the principles for choosing types of machines for specific energy systems that ensure high efficiency and reliability of installations.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- know the design of superchargers and heat engines.

- demonstrate thermal and strength processes in the flow parts and parts of bladed machines and the basis for their calculation.

- choose superchargers and heat engines depending on their purpose.

Prerequisites
Fluid and gas mechanics
Postrequisites
Final examination

Physico-chemical methods of water preparation

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course is aimed at studying the basic qualities of natural waters and physical and chemical methods of water preparation. Technological indicators of water quality and circulation in the operating cycle of a thermal power plant are considered. The main classifications of ways and methods of water treatment are described. Attention is paid to the main methods of removing corrosive gases and impurities from water in order to implement reliable optimal conditions for the water-chemical regime of thermal power plants.
Purpose of studying of the discipline
The purpose of studying the discipline is to form students` knowledge of the theoretical foundations of applied and promising physical and chemical methods of water treatment used in boiler houses, thermal power plants and other industrial facilities using water and steam as a heat carrier.
Learning Outcomes
ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.
Learning outcomes by discipline
- carry out calculations of the main parameters of individual stages of water treatment.
- to simulate water treatment systems using computer technology.
- design water treatment systems taking into account the initial data and the requirements.
Prerequisites
Chemistry
Postrequisites
The thermal network

Water conditioning

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is aimed at studying the characteristics and main indicators of water quality, as well as water treatment processes. The main stages of water purification methods are considered. The types of coagulants and processes used in water coagulation are studied. Methods and principles of water quality analysis are described. The description of the main equipment and means of automation of water treatment plants is given. The basic concepts of the operation of water treatment equipment and water quality control are considered.
Purpose of studying of the discipline
The purpose of mastering the discipline is to study by students the technologies and processes for the treatment of natural and waste water for drinking water supply and the technological needs of industrial enterprises, mastering the principles and methods of water treatment and waste water treatment.
Learning Outcomes
ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.
Learning outcomes by discipline
- know the characteristics of impurities and the main indicators of water quality; basic methods of water purification.
- calculate the main parameters of individual stages of water treatment, the intensity of deposits and the rate of corrosion processes, design water treatment systems, taking into account the initial data and requirements.
- determine and analyze the quality of the source water of water treatment plants.
Prerequisites
Chemistry
Postrequisites
The thermal network

Waste water treatment technology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is devoted to the study of modern problems of wastewater pollution sources. Methods and technologies for wastewater treatment are being studied, such as: hydromechanical treatment; physical and chemical cleaning; biochemical and thermal purification. The basics of designing a technological scheme for wastewater treatment are given and studied. Modern wastewater treatment

methods and technologies for their implementation and improvement are considered.

Purpose of studying of the discipline

The purpose of the discipline is to form students` theoretical knowledge of the physical and chemical foundations and technologies for treating natural and waste water and develop practical skills in choosing technological schemes for treating water of various compositions.

Learning Outcomes

ON8 Describe the principles of operation and conduct of heat engineering calculations of developed and used heat power and heat technology installations and systems.

Learning outcomes by discipline

- know the methods of development, research and design of effective environmentally friendly technologies for wastewater treatment.
- apply calculation methods for the selection, development and operation of environmental protection means.
- choose rational technological schemes for wastewater treatment and its instrumentation.

Prerequisites

Chemistry

Postrequisites

The thermal network

Dosimetric instruments

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline describes the types and principles of operation of devices for measuring ionizing radiation, dose rates of radioactive substances, volumes and masses of samples of radioactive substances. The purpose of studying the discipline is to form students` knowledge about the nature of the occurrence of ionizing radiation, radionuclides, radiation safety and protection measures. And also in the ability to apply measurement methods and conditions for safe work with radiation sources.

Purpose of studying of the discipline

Training students in the field of methods and means of quantitative measurement of ionizing radiation, ensuring radiation safety of humans and the environment, organization of radiation and radioecological safety services.

Learning Outcomes

ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline

- choose and use dosimetric and radiometric equipment.
- to determine dose loads on humans and environmental objects located in the fields of ionizing radiation.
- to carry out dosimetric and radiometric measurements.

Prerequisites

Electrical engineering and electronics

Postrequisites

TPP operation and safety precautions

Means of accounting and control in the thermal power industry

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Discipline «Means of accounting and control in power» - the use of measuring and auxiliary devices for measuring temperature, pressure, flow rate of liquid, gas, steam. Accounting and control of electrical and thermal energy to the consumer for more efficient use of energy resources. The use of digital instruments and digital computers for accounting and control of measuring instruments in thermal power facilities.

Purpose of studying of the discipline

The study of measurements of thermal parameters, familiarization with the main types of instruments and information- measuring systems in the operation of power plants.

Learning Outcomes

ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline

- apply methods for determining and standardizing the main metrological characteristics of typical measuring devices, basic methods and means for measuring thermal parameters.
- know the technical characteristics, principles of operation, design features of the technical measuring instruments used, standards for verification and calibration of thermotechnical measuring devices.
- determine the static and dynamic characteristics of measuring instruments and systems.

Prerequisites

Electrical engineering and electronics

Postrequisites

TPP operation and safety precautions

Technical instruments and measurements in thermal power engineering

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course of the discipline provides general information about the measurements used in thermal power engineering and thermal technology. The principles of operation and features of modern devices and means for measuring temperature, pressure, quantity and consumption of substances are considered. Methods for conducting modern measurements in thermal and nuclear power plants are given. As well as measuring the microclimate of residential and public buildings for heating, ventilation and air conditioning systems.

Purpose of studying of the discipline
The objectives of the study of the discipline - is to form a general idea, to master the methods and modern technical means for measuring thermal parameters, methods and technical means for monitoring the composition and quality of technological environments in thermal power engineering.

Learning Outcomes
ON6 Operate knowledge in the field of electrical engineering, measuring instruments, automation and information technology in their subject area.

Learning outcomes by discipline
- know the basic principles of error estimation and the rules for their rounding, standardization of the metrological characteristics of measuring instruments, accuracy classes and their designations.
- apply the methods of calculated summation of individual components of the error when evaluating the result of direct, linear and nonlinear measurements.
- to have the skills of a rational choice of measuring instruments, organization of their trouble-free operation.

Prerequisites
Electrical engineering and electronics

Postrequisites
TPP operation and safety precautions

Energy saving in industrial enterprises

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline is aimed at studying the methods of energy saving in industrial heat and power enterprises. The main types and stages of energy inspections (energy audit) are considered. Attention is paid to energy efficiency and rational use of fuel and energy resources. Typical energy-saving measures implemented to improve the energy efficiency of industrial enterprises are being studied. An assessment is given of modern energy-saving technologies using information and communication technologies in energy saving.

Purpose of studying of the discipline
Obtaining knowledge on the basics of conducting an energy audit of industrial enterprises and housing and communal services, compiling an energy passport for a consumer of energy resources, and introducing standard energy-saving measures.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- use the main legal documents in the field of energy saving, the composition of the energy passport of an industrial enterprise.
- find organizational and technical solutions to improve the efficiency of fuel and energy use; analyze information about new types of energy-efficient equipment and energy-saving technologies.
- carry out calculations of the energy balance of the enterprise, its energy saving potential and efficiency indicators of energy consumption at the enterprise.

Prerequisites
Automation of the power equipment of thermal and nuclear power plants

Postrequisites
Final examination

Basics of nature

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is aimed at studying the basics of nature management. The types, forms and mechanisms of rational nature management are considered. Ways of rational use of natural resources are being studied, as well as the concept of sustainable development of mankind and the problems of nature management. Attention is paid to the conservation, restoration and rational change of the ecological balance of natural systems. The sustainable development of energy and ecology is being studied in order to rationally improve nature management.

Purpose of studying of the discipline
Formation of theoretical and practical foundations for rational nature management and mechanisms for its implementation, systematic information about natural conditions and resources, the features of their use, reproduction and protection.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- understand the features of the interaction between society and nature, the main sources of man-made impact on the environment.
- analyze and predict the environmental consequences of various activities.
- use legal documents.
Prerequisites
Automation of the power equipment of thermal and nuclear power plants
Postrequisites
Final examination

Energy saving in heat power engineering and heat technology

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course is devoted to an overview of the existing problems and the main trends in the development of modern domestic and global energy. The issues of energy saving and energy efficiency in the production of electric and thermal energy are considered. Modern methods and technologies that significantly reduce the anthropogenic impact of heat-generating enterprises on the environment are being studied. Laws and programs in the Republic of Kazakhstan and measures for their implementation are being studied.
Purpose of studying of the discipline
Formation of knowledge, skills and abilities for energy saving in the fuel and energy complex, industries, transport, agro-industrial complex, public utilities and the use of non-traditional renewable energy sources.
Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.
Learning outcomes by discipline
- analyze the state, problems and directions of development of energy conservation in the world and the Republic of Kazakhstan at the present time and in the future.
- to explain the principles of the state policy of energy conservation.
- draw up fuel and energy balances of industrial enterprises.
Prerequisites
Automation of the power equipment of thermal and nuclear power plants
Postrequisites
Final examination

Principles of NPP safety assurance

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
When studying the discipline, the main issues of the principles of ensuring the safety of nuclear power plants are considered. Fundamentals of radiation, technical safety in the operation of power plants. Emergencies, the reason for their occurrence, methods of prevention and localization with modern protection systems. Normative and technical documentation on the organization of control, reliability, and safety of nuclear power plants are being studied. Methods for processing and disposal of nuclear waste.
Purpose of studying of the discipline
Formation of students` knowledge and skills of using the basics of radiation safety to ensure safe life, studying the regulatory documentation of the Republic of Kazakhstan in the field of the use of atomic energy.
Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.
Learning outcomes by discipline
- use the basic norms and rules of radiation safety; principles of handling and storage of spent nuclear fuel and radioactive waste.
- apply the regulatory documentation of the Republic of Kazakhstan in the field of the use of atomic energy to ensure the safe life of the population.
- predict and analyze emergencies at nuclear power plants and take appropriate measures to eliminate its consequences.
Prerequisites
Bases of economics, law and ecological knowledge
Postrequisites
Final examination

TPP operation and safety precautions

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline is aimed at studying and mastering the basic principles and modes of operation of thermal power plants. It describes the safe performance of work on the operation, repair, adjustment of thermal, mechanical and water treatment equipment, automation and measurement systems at thermal power plants and boiler houses. The safety rules for the operation of the main and auxiliary equipment of thermal power plants are described in more detail.

Purpose of studying of the discipline
It is the acquisition of knowledge on the basics of proper technical operation and methods of maintaining rational modes of operation of thermal power equipment of IES and CHPPs, ensuring safety, trouble-free operation and high efficiency of operation, rational passage of peaks and dips in electrical load and heat supply to consumers, taking into account the latest achievements of thermal power engineering in this area.
Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.
Learning outcomes by discipline
- describe the characteristics and fundamentals of operation of the main equipment of the TPP.
- explain the variable operating modes of steam turbines and boilers.
- describe the processes occurring under variable operating modes of the TPP.
Prerequisites
Bases of economics, law and ecological knowledge
Postrequisites
Final examination

Energy life support systems and safety

Discipline cycle	Profiling discipline
Course	4
Credits count	6
Knowledge control form	Examination

Short description of discipline
The discipline studies the basic concepts of the energy system, the principles of operation and operation of energy systems that ensure the safe consumption of energy resources for life support. Methods for estimating the operating parameters of the energy life support system are outlined. Development and calculation of microclimate systems (heating, ventilation, air conditioning). Energy- saving measures in energy systems that provide comfortable living conditions. The issues of labor protection and safety are also considered.
Purpose of studying of the discipline
The purpose of the discipline is to study the structure, and technical foundations and principles of functioning of production systems, transport and consumption of technological energy carriers in accordance with the requirements of reliability, efficiency and safety.
Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.
Learning outcomes by discipline
- apply methods and means of creating standard atmospheric conditions at workplaces by means of ventilation; the current state of heating systems for industrial enterprises and domestic hot water supply.
- to solve the problems of design and control of heating and ventilation systems of industrial facilities.
- use methods for solving problems of heat supply and industrial ventilation.
Prerequisites
Bases of economics, law and ecological knowledge
Postrequisites
Final examination

The thermal network

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The issues of heat supply systems for domestic and industrial consumers are considered. Thermal networks and their constructive components are studied. Laying of thermal networks: ground, underground, channel and channelless. Methods of hydraulic calculation of heat networks, calculation and selection of pipelines are given. Evaluation and elimination of heat losses in heat networks. The issues of thermal insulation of pipelines, selection and calculation of thermal insulation are also outlined.
Purpose of studying of the discipline
The purpose of the discipline: the study of the fundamentals of the theory of heating, design features of heating systems, methods of calculation, characteristics and modes of operation of heat supply systems, the study of the features of hydraulic and thermal calculations of heat networks, the choice of operating mode and operation of heat supply systems, as well as the choice of equipment for thermal and individual points.
Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.
Learning outcomes by discipline
- describe the principles of heat supply.
- to explain the constructive device of thermal networks.
- consider methods of heat load regulation.
Prerequisites
Thermodynamic fundamentals cycles of thermal power plants
Postrequisites
Final examination

Operation and technical service of turbine equipment

Discipline cycle	Profiling discipline
Course	4

Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The discipline «Operation and technical service of turbine equipment» deals with turbine equipment of thermal and nuclear power plants. The main issues on the type and design, operation and maintenance of turbine equipment are outlined. Particular attention is paid to the section - the main and auxiliary equipment of turbine installations, the mode of operation, control and protection systems for turbines, as well as the operation of instrumentation.

Purpose of studying of the discipline
The purpose of the discipline is to acquire knowledge about modern methods of maintenance and diagnostics of thermal power equipment, the formation of skills in mastering advanced technologies and technical means of monitoring and assessing the state of turbine equipment in its operation.

Learning Outcomes
ON10 Calculate and regulate energy production and distribution systems.

Learning outcomes by discipline
- use the procedure for servicing the turbine and auxiliary equipment; requirements of the rules of technical operation, safety regulations for the maintenance of turbine installations.
- choose the optimal mode of operation of the turbine.
- design technological and complete schemes of the turbine shop.

Prerequisites
Thermodynamic fundamentals cycles of thermal power plants

Postrequisites
Final examination

Modern methods of energy conversion (in english)

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is devoted to the study of modern thermal (thermodynamic), photovoltaic and photochemical methods of converting various energy sources. The advantages and disadvantages of each of the methods of energy conversion are discussed. The expediency of their application is determined depending on the specific source of energy production. Attention is paid to the issue of improving the efficiency of modern power plants running on organic fuel and unconventional sources of energy.

Purpose of studying of the discipline
The purpose of the discipline is: the study and application of modern, promising ways of converting energy, technologies for the production of thermal and electrical energy.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- describe technological schemes for the production of electrical and thermal energy.
- explain the principles of operation of the main and auxiliary equipment of power plants.
- identify current problems and tasks in the field of environmentally friendly conversion of energy carriers.

Prerequisites
Foreign language Introduction to the specialty

Postrequisites
Final examination

Modern methods of energy conversion (in russian)

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course is aimed at studying modern methods and methods of converting various types of energy. The course describes the classification of forms and types of energy, pays attention to improving the designs of thermal power plants and the principles of their operation. Magnetohydrodynamic generators, Faraday`s laws, energy conservation, electromagnetic induction are considered. The principles of operation of organic solar cells based on planar heterojunction are studied.

Purpose of studying of the discipline
The purpose of the discipline is to acquire knowledge on the current state and general problems of energy in the development of the heat and power industry.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- use methods for assessing the main types of energy resources and converting them into electrical and thermal energy.
- analyze technological schemes for the production of electrical and thermal energy.
- own the issues of energy saving in the energy system.

Prerequisites
Foreign language Introduction to the specialty

Postrequisites

Final examination

Energy in Kazakhstan

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course examines the energy sector of the Republic of Kazakhstan, the state and prospects of the country`s energy development. Attention is paid to the development of renewable energy sources and nuclear energy. The key factors of production and transmission of electric energy in Kazakhstan are considered. The electric energy market, energy-producing and energy-supplying organizations and operators are being studied. The issues of energy development based on the creation, consolidation and unification of energy systems are being studied.

Purpose of studying of the discipline
The purpose of this course is to analyze the state of the energy industry in Kazakhstan, as well as to monitor the development of the fuel and energy complex of the country as a whole.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- analyze the country`s energy industry.
- apply methods of direct production of electrical energy with the methods of energy conversion used in modern power plants.
- use knowledge when working in autonomous stations that directly convert various types of energy into electrical and thermal energy.

Prerequisites
Foreign language Introduction to the specialty

Postrequisites
Final examination

Alternative and renewable energy sources

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the current state of the fuel and energy complex of the Republic of Kazakhstan, as well as the technology for the production of electrical and thermal energy based on non-traditional and renewable energy sources. The features of the use of renewable energy sources are studied. Attention is paid to the current state of the use of non-traditional and renewable energy sources, with the problems and prospects for the development of these areas in the thermal power industry.

Purpose of studying of the discipline
Formation of general principles for the use of non-traditional and renewable energy sources in solving problems of energy use in heat technology production.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- evaluate the state, problems and directions of development of non-traditional energy in the world and Kazakhstan at the present time and in the future.
- apply the basic principles of the state policy on the use of non-traditional energy sources.
- make calculations on the use of power plants on renewable energy sources.

Prerequisites
Introduction to the specialty

Postrequisites
Final examination

Basics of alternative energy

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course examines the current state and prospects for the development of non-traditional energy in the fuel and energy balance. The principles of operation and design of power plants using non-traditional types of energy are described. The main modes of operation of non-traditional energy sources are studied, as well as the principles and practical use in thermal power engineering. Attention is paid to modern methods and possibilities of using waste and biomass as sources of electrical and thermal energy.

Purpose of studying of the discipline
The purpose of mastering the discipline is to form knowledge on the current state and use of non-traditional and renewable energy sources, their energy, economic and environmental characteristics.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- be able to analyze the energy balances of industrial enterprises using non-traditional energy sources.

- evaluate the efficiency of the use of non-traditional energy in the sectors of the national economy.
- use calculation methods in the field of non-traditional energy.

Prerequisites
Introduction to the specialty

Postrequisites
Final examination

Theoretical Foundations of spectrometry

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
Studying this discipline, students develop the following knowledge and skills: the concepts of spectrometry and its theoretical foundations, the basic principles of the spectrometry method. Methods of ionization of volatile and nonvolatile substances, liquids and gases, electron ionization of substances in liquid and gas phases are studied. Classification of ionization methods. Charged particles of electric and magnetic fields. Mass spectrometry and mass analyzers.

Purpose of studying of the discipline
The purpose of mastering the discipline is to form the foundations of deep knowledge in the field of various spectrometric methods. Development of students` competencies, allowing them to carry out professional activities in the future, by mastering the theoretical and experimental foundations of the most important methods of spectrometry.

Learning Outcomes
ON7 Apply theoretical and practical knowledge necessary for the use of innovative technologies and techniques in the field of energy.

Learning outcomes by discipline
- know the main stages in the development of spectroscopy as a branch of science; classification of ionizing radiation spectrometers and their general characteristics; methods and technical means of spectrometry of flows of charged particles and gamma radiation.
- determine the type of spectral device required for the spectral analysis of a particular object.
- have the skills of practical work on spectral devices and modern technologies used in processing the results of spectrometric analysis.

Prerequisites
Introduction to the specialty

Postrequisites
Final examination

Thermal mechanical and auxiliary equipment of power plants

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The main characteristics and principles of operation of thermal and nuclear power plants are considered. The issues of design and calculations, operation and classification of thermal mechanical and auxiliary equipment of thermal and nuclear power plants are outlined. Heat-exchange equipment and hydraulic processes occurring in them, thermodynamic cycles of steam turbine, gas turbine installations, and schematic diagrams of power plants are studied. Thermal and design calculations of the main and auxiliary equipment of power plants are carried out.

Purpose of studying of the discipline
Obtaining knowledge by students about the state and prospects for the development of thermal mechanical and auxiliary equipment, which ensures reliable, safe and economical operation of power plants.

Learning Outcomes
ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline
- to consider the principles and functioning of heat and mass transfer devices of energy systems of industrial enterprises.
- choose auxiliary equipment of heat sources and heat supply systems of an industrial enterprise.
- analyze the processes occurring in the auxiliary equipment of power plants.

Prerequisites
Thermal and nuclear power stations

Postrequisites
Final examination

Technological energy resources of enterprises

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This training course of the discipline is aimed at studying the main methods of energy production and distribution systems, principles, structure and their functioning. Questions of fuel supply systems, water supply, air supply of industrial enterprises are being studied. The characteristics and calculations of the main and auxiliary equipment of these systems are given. The issues of operation of the main equipment at industrial enterprises are considered. A feasibility study is given for the used and designed schemes for the production and

consumption of energy carriers.

Purpose of studying of the discipline

The purpose of teaching the discipline is to study the structure, theoretical and technical foundations and principles of functioning of the systems of production, transport and consumption of technological energy carriers.

Learning Outcomes

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- understand the systems of production and distribution of energy carriers in an industrial enterprise.
- determine the costs of energy, material resources in the energy supply systems of the enterprise and develop ways to reduce these costs.
- analyze and calculate the needs of the enterprise in energy carriers for technological and energy consumers.

Prerequisites

Thermal and nuclear power stations

Postrequisites

Final examination

Refrigeration units

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

The area of study of the discipline is refrigeration cryogenic equipment and technology. The discipline is aimed at studying the cooling processes occurring in the elements of refrigeration units. Cycles, schemes and layouts of refrigeration units. Classification of refrigeration units in various areas of their application. Thermal and constructive calculations of elements of refrigeration units. Calculation and selection of the main and auxiliary refrigeration equipment. Characteristics and types of refrigerants.

Purpose of studying of the discipline

The purpose of the discipline is the formation of students` systems of knowledge, skills and professional competencies in the field of device, operation, as well as operation and maintenance of a refrigeration unit.

Learning Outcomes

ON2 Apply methods for calculating and selecting equipment for energy systems, ventilation and air conditioning systems based on the latest achievements of science and technology
ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- know the scope of various cooling systems, various schemes of refrigeration units.
- calculate, design and test elements of refrigeration units.
- apply methods of calculation and design of thermal insulation of cooled objects.

Prerequisites

Thermal and nuclear power stations

Postrequisites

Final examination

Undergraduate practice

Discipline cycle	Profiling discipline
Course	4
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline

Purposeful and active work of the student to collect the necessary material for the completion of the graduation project, obtaining and consolidating design skills. Completion of writing a diploma project using the experience and knowledge gained during the pre-diploma practice with the fulfillment of the assigned tasks.

Purpose of studying of the discipline

Improving the quality of training students by mastering the methods and techniques of processing the material collected during the internship for writing and defending a graduation project.

Learning Outcomes

ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.

Learning outcomes by discipline

- use the rules and regulations for the design, construction, installation and operation of heat and power systems and installations;
- take the necessary measures to ensure life safety and environmental protection in the production, construction and operation of thermal power plants and systems;
- choose the main and auxiliary equipment;
- to carry out technological, thermal and hydraulic tests of equipment;
- choose and calculate treatment facilities for capturing thermal and technological emissions;
- to carry out operation and adjustment of heat power and heat technological equipment of industrial enterprises
- plan participation in carrying out scheduled tests and repairs of technological equipment, installation, commissioning and commissioning, including when mastering new equipment and (or) technological processes;
- apply methods for determining technological indicators of water and fuel quality.

Prerequisites
Manufacturing practice II
Postrequisites
Final examination

Manufacturing practice III

Discipline cycle	Profiling discipline
Course	4
Credits count	15
Knowledge control form	Total mark on practice

Short description of discipline
Consolidation of experience and skills in production-technological, organizational-management, installation and adjustment, calculation and design, experimental and research activities acquired in the study of major disciplines.
Purpose of studying of the discipline
Consolidation and deepening of the theoretical knowledge gained in the process of studying at the university, the implementation of the adaptive capabilities of the student to new working conditions, as well as the development of skills and mastery of professional knowledge.
Learning Outcomes
ON9 Perform calculations according to standard methods and design individual parts and assemblies using standard design automation tools in accordance with the terms of reference.
Learning outcomes by discipline
- choose the main and auxiliary equipment;
- to carry out technological, thermal and hydraulic tests of equipment;
- to carry out scheduled tests of technological equipment;
- plan participation in carrying out scheduled tests and repairs of technological equipment, installation, commissioning and commissioning, including the development of new equipment and (or) technological processes.
Prerequisites
Manufacturing practice II
Postrequisites
Final examination