



# EDUCATIONAL PROGRAM

**6B05 - Natural Sciences, Mathematics and Statistics**

(Code and classification of the field of education)

**6B053 - Physical and chemical sciences**

(Code and classification of the direction of training)

**0530**

(Code in the International Standard Classification of Education)

**B054 - Physics**

(Code and classification of the educational program group)

**6B05303 - Technical physics**

(Code and name of the educational program)

**Bachelor**

(Level of preparation)

**Semey**

## **Educational program**

**6B05 – Natural Sciences, Mathematics and Statistics**  
(Code and classification of the field of education)

**6B053 - Physical and chemical sciences**  
(Code and classification of the direction of training)

**0530**  
(Code in the International Standard Classification of Education)

**B054 - Physics**  
(Code and classification of the educational program group)

**6B05303 - Technical Physics**  
(Code and name of the educational program)

**Bachelor**  
(Level of preparation)

## PREFACE

### Developed

The educational program 6B05303 - Technical Physics in the direction of preparation 6B053 - Physical and chemical sciences on the basis of the State Compulsory Standards of Higher and Postgraduate Education approved by the Order of the Ministry of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No 2 (as amended by the order) was developed by the Academic Committee dated 20.02.2023 No 66).

Members of the Academic Committee	Full name	Academic degree, academic title, position
Head of the Academic Committee	Kasymov Askar	PhD, Dean Research School of Physical and Chemical Sciences
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### Reviewing

Full name of the reviewer	Position, place of work
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### Reviewed

At the meeting of the Commission on Academic Quality of the Faculty of Engineering and Technology  
Protocol №3 15.01. 2024

At a meeting of the Academic Quality Commission of the Research School of Physical and Chemical Sciences

Recommended for approval by the University Academic Council  
Protocol No. 1 June 06, 2024

### Approved

at a meeting of the University Academic Council by protocol No. 6/1 of January 19, 2024.

at a meeting of the University Academic Council by protocol No. 11 of June 28, 2024.

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# 1.Introduction

## 1.1.General data

1.1. Department of "Technical Physics and Heat Power Engineering" of the Research School of Physical and Chemical Sciences of the NJSC «University named after Shakarim of the city of Semey», carries out training in the educational program "6B05303 Technical Physics", taking into account the needs of the regional labor market, the requirements of regulatory documents of the Ministry of Education and Science of the Republic of Kazakhstan. When implementing the educational program, training is carried out in the specialization of training - these are "Nuclear Reactors and Power Plants" and "Engineering and Physics of Low Temperatures". These areas of training of specialists in the field of nuclear energy and low-temperature technology in the territory of the Republic of Kazakhstan within the framework of the educational program are not produced by anyone other than the Shakarim State University of Semey. The training of bachelors in this area is carried out in close cooperation with the National Nuclear Center of the Republic of Kazakhstan (Kurchatov), on the basis of which a branch of the department has been opened. On the basis of the branch, all types of internships are carried out, as well as diploma design. The leaders of the diploma projects are leading specialists from research laboratories. The defense of diploma projects is carried out at the NNC RK with the involvement of leading scientists. This approach in the education process allows to prepare future specialists in the field of technical physics, taking into account the requirements of the future employer.

When implementing the educational program, it is planned to use artificial intelligence tools in the educational process, thereby developing digital competencies among students in a rapidly changing technological environment.

The educational program provides for the education of a student with special educational needs in the conditions of a higher educational institution, as well as his socialization and integration into society.

## 1.2.Completion criteria

The main 205 credits of theoretical training, as well as at least 27 credits of practical training, 8 credits of final certification.

A total of criterion for the completion of the educational process for the preparation of bachelors is the mastering by students of at least 240 credits

## 1.3.Typical study duration: 4 years.

## 2.PASSPORT OF THE EDUCATIONAL PROGRAM

<b>2.1.EP purpose</b>	Preparation of specialists with extensive knowledge for modern high-tech industries focused on design, technological and developmental activities in the field of technical physics related to the nuclear industry and low-grade technology.
<b>2.2.Map of the training profile within the educational program</b>	
Code and classification of the field of education	6B05 - Natural Sciences, Mathematics and Statistics
Code and classification of the direction of training	6B053 - Physical and chemical sciences
Code in the International Standard Classification of Education	0530
Code and classification of the educational program group	B054 - Physics
Code and name of the educational program	6B05303 - Technical Physics
<b>2.3.Distinctive features of the OP (double degree/joint, OVPO-partner, Double major, innovative)</b>	-
<b>2.4.Qualification characteristics of the graduate</b>	
Degree awarded / qualification	Bachelor of Science in Education Program
Name of professional standard	Professional standard: "Radiation monitoring" Professional standard: "Ventilation and air conditioning services for residential and non-residential buildings"
Atlas of new professions	-
Regional standard	-
Name of the profession / list of positions of a specialist	They can hold primary positions: physicist, circuit engineer, electronic engineer, technologist, specialist of the highest, I and II categories, senior laboratory assistant, engineer.
OQF qualification level (industry qualification framework)	6
Area of professional activity	Industry, energy industry, education, science.
Object of professional activity	Enterprises and firms of energy and technological profiles in the field of nuclear energy and low-temperature technology. Scientific research institutions. Higher and secondary specialized educational institutions.
Types of professional activity	Experimental - research. Research. Production and technological. Installation and operational. Organizational and managerial.
<b>2.5.Graduate Model</b>	Demonstrate socio-cultural, economic, legal, environmental knowledge, communication skills, apply information technology, taking into account modern trends in the development of society. Apply laws and regulations in the field of economics and law, ecology and life safety, as well as the skills of entrepreneurship, leadership, and receptivity of innovations. To apply in cognitive and professional activities basic knowledge in the field of mathematics and physics, methods of mathematical analysis and modeling, theoretical and experimental research.

	<p>Apply in the educational, scientific and professional activities the requirements of the rules and standards of documentation.</p> <p>Use the fundamental laws of mechanics, thermodynamics, heat and mass transfer and their practical applications.</p> <p>Operate knowledge in the field of electrical engineering, measuring instruments, electronics and information technology in their subject area.</p> <p>Apply laws describing the flow of physical processes in the microworld, the mathematical apparatus of nonrelativistic quantum mechanics, methods for calculating the physical properties of materials, assessing the applicability of approximations in educational, research and practical activities.</p> <p>Use the rules of work organization with compliance with safety requirements on the basis of the relevant legislative and regulatory framework in the field of labor protection, radiation safety, fire safety in the energy sector.</p> <p>To substantiate the methods of calculation and selection of equipment for the nuclear industry, alternative and renewable energy for the production of cold, ventilation and air conditioning systems based on the achievements of science and technology.</p> <p>Conduct feasibility studies of the efficiency of energy systems in the field of high and low temperatures, energy-saving equipment using the necessary materials of existing industries.</p>
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### 3. Modules and content of the educational program

#### Module 1. Fundamentals of social and humanitarian knowledge

##### Brief description of the module content

Данный модуль раскрывает такие аспекты как: социально-культурные, экономико-правовые, экологические знания, коммуникативные умения, применение информационных технологии с учетом современных тенденций развития общества.

##### Module disciplines

Foreign language

Kazakh(Russian) language (1)

Bases of economics, law and ecological knowledge

Physical Culture

Foreign language

History of Kazakhstan

Kazakh(Russian) language (2)

The module of socio-political knowledge (sociology, political science, cultural studies, psychology)

Physical Culture

Physical Culture

World of Abai

Information and communication technology

Physical Culture

Philosophy

#### Module 2. Application in cognitive and professional activities of basic knowledge in the field of mathematics and physics

##### Brief description of the module content

The module includes the study in cognitive and professional activities of basic knowledge in the field of mathematics and natural sciences, methods of mathematical analysis and modeling, theoretical and experimental research in the field of energy.

##### Module disciplines

Mathematics

Physics

#### Module 3. Application in educational, scientific and professional activities of the requirements to the graduate

##### Brief description of the module content

The module is aimed at forming requirements for a graduate of an educational program in educational, scientific and professional activities.

##### Module disciplines

Introduction to Specialty

History of the development of energy

Basics of Alternative Energy

Application of USDD standards in the design of engineering documentation.

Educational practice

#### Module 4. Application of fundamental laws of mechanics, thermodynamics and heat exchange

##### Brief description of the module content

The module is focused on studying the fundamental laws of mechanics, thermodynamics, heat and mass transfer and their practical applications.

##### Module disciplines

Theoretical basics of heat engineering

Heat engineering



Thermodynamics  
Technical Mechanics  
Fluid Dynamics  
Heat and Mass Transfer  
Heat and mass transfer processes and apparatuses thermotechnologi  
Chemical thermodynamics

## **Module 5. Operation of knowledge in the field of electrical engineering, electronics and information technology**

### **Brief description of the module content**

The module includes the study of knowledge in the field of electrical engineering, measuring instruments, electronics and information technology in its subject area.

### **Module disciplines**

Computer technologies in the energy sector  
Simulation of the electric  
Applied Electronics  
Electrical engineering and electronics  
Elements of computer graphics in technical physics  
Elements of computer graphics and CAD bases in technical physics

## **Module 6. Application of physical laws in educational, research and practical activities**

### **Brief description of the module content**

The module includes the study of laws that describe the occurrence of physical processes in the microcosm, the mathematical apparatus of non-relativistic quantum mechanics, methods for calculating the physical properties of materials, and assessing the applicability of approximations in educational, research and practical activities.

### **Module disciplines**

Applied Optics  
Elementary particle Physics  
Nuclear physics  
Introduction to Medical Physics  
Molecular Physics and Thermodynamics  
Applied Thermal Physics  
Manufacturing practice I  
Statistical physics and thermodynamics  
Neutron transport theory  
The nuclear and neutron physics  
Atomic physics  
Theoretical Foundations of spectrometry  
The physics of the atom and atomic phenomena  
Physics of the condensed state  
Physics of semiconductors and dielectrics  
Solid state physics  
Computational methods in quantum physics  
Quantum mechanics  
Quantum mechanics of molecules  
Introduction to scientific activity

## **Module 7. Using the legislative and regulatory framework to organize work in compliance with safety requirements**

### **Brief description of the module content**

The module is aimed at studying the rules for organizing work in compliance with safety requirements based on the relevant legislative and regulatory framework in the field of labor protection, radiation safety, fire safety in the energy sector.

**Module disciplines**

Applied physics and radiation safety  
Principles of nuclear safety  
Radioecology and radiation safety  
Information technology and techniques in engineering education  
Basics of modern energy in English  
Basics of Heat Transformation  
Manufacturing practice II  
Heat pumps  
Heat and mass transfer in power plants  
Formation of the technical thesaurus  
Basics cryosystems  
Processes and equipment of cooling gas  
Thermophysical processes in cryogenic systems  
Specifications and technical documentation on labor protection  
Occupational Safety and Health  
Occupational health and safety in the Technical Physics  
Spectrometry radiation and methods of recording radiation  
Physics of radiation protection  
Radiometry

**Module 8. Establishment of calculation methods and selection of equipment for nuclear power, non-traditional and renewable energy**

**Brief description of the module content**

The module studies calculation methods and selection of equipment for the nuclear industry, non-traditional and renewable energy based on the achievements of science and technology.

**Module disciplines**

Alternative and renewable energy sources  
Energy equipment NEI  
Nuclear research reactors  
ACS processes NPI  
Fundamentals of reactor physics  
Controlled thermonuclear fusion  
Nuclear fuel cycle

**Module 9. Substantiation of calculation methods and selection of equipment for the production of cold, ventilation and air conditioning systems**

**Brief description of the module content**

The module examines the study of calculation methods and selection of equipment for the production of refrigeration, ventilation and air conditioning systems based on the achievements of science and technology.

**Module disciplines**

Air conditioning and ventilation  
Chillers  
Refrigerators  
Automation of refrigeration  
Installation, diagnostics and repair of refrigeration equipment  
Bases for design and construction of refrigerating machines with elements of CAD

The basic technology of production of consumers of artificial cold

## **Module 10. Conducting a feasibility study of the efficiency of energy systems in the field of high and low temperatures, energy-saving equipment**

### **Brief description of the module content**

The module examines feasibility studies of the efficiency of energy systems in the field of high and low temperatures, energy-saving equipment using the necessary materials from existing industries

### **Module disciplines**

Economics of enterprise

Prediploma practice

Manufacturing practice III

### **Final examination**

### **Brief description of the module content**

Writing and defending a graduation project or preparing and passing a comprehensive exam.

### **Module disciplines**

Diploma project

Comprehensive exam

## 4.Summary table on the scope of the educational program

### «6B05303 - Technical Physics»

Name of discipline	Cycle/ Component	Term	Number of credits	Total hours	Lec	SPL	LC	IWST	IWS	Knowledge control form
<b>Module 1. Fundamentals of social and humanitarian knowledge</b>										
Foreign language	GER/CC	1	5	150		45		35	70	Examination
Kazakh(Russian) language (1)	GER/CC	1	5	150		45		35	70	Examination
Bases of economics, law and ecological knowledge	GER/US	1	5	150	15	30		35	70	Examination
Physical Culture	GER/CC	1	2	60		60				Differentiated attestation
Foreign language	GER/CC	2	5	150		45		35	70	Examination
History of Kazakhstan	GER/CC	2	5	150	15	30		35	70	Qualification examination
Kazakh(Russian) language (2)	GER/CC	2	5	150		45		35	70	Examination
The module of socio-political knowledge (sociology, political science, cultural studies, psychology)	GER/CC	2	8	240	30	45		55	110	Examination
Physical Culture	GER/CC	2	2	60		60				Differentiated attestation
Physical Culture	GER/CC	3	2	60		60				Differentiated attestation
World of Abai	BS/US	3	3	90	15	15		20	40	Examination
Information and communication technology	GER/CC	4	5	150	15	15	15	35	70	Examination
Physical Culture	GER/CC	4	2	60		60				Differentiated attestation
Philosophy	GER/CC	5	5	150	15	30		35	70	Examination
<b>Module 2. Application in cognitive and professional activities of basic knowledge in the field of mathematics and physics</b>										
Mathematics	BS/US	1	5	150	15	30		35	70	Examination
Physics	BS/US	1	3	90	15	15		20	40	Examination
<b>Module 3. Application in educational, scientific and professional activities of the requirements to the graduate</b>										
Introduction to Specialty	BS/CCh	1	3	90	15	15		20	40	Examination
History of the development of energy	BS/CCh	1	3	90	15	15		20	40	Examination
Basics of Alternative Energy	BS/CCh	1	3	90	15	15		20	40	Examination
Application of USDD standards in the design of engineering documentation.	BS/US	2	5	150	15	30		35	70	Examination
Educational practice	BS/US	2	2	60						Total mark on practice
<b>Module 4. Application of fundamental laws of mechanics, thermodynamics and heat exchange</b>										
Theoretical basics of heat engineering	BS/CCh	3	5	150	15	15	15	35	70	Examination

Heat engineering	BS/CCh	3	5	150	15	15	15	35	70	Examination
Thermodynamics	BS/CCh	3	5	150	15	15	15	35	70	Examination
Technical Mechanics	BS/US	3	5	150	15	30		35	70	Examination
Fluid Dynamics	BS/US	4	5	150	15	30		35	70	Examination
Heat and Mass Transfer	BS/CCh	4	5	150	15	30		35	70	Examination and term work/Project
Heat and mass transfer processes and apparatuses thermotehnologi	BS/CCh	4	5	150	15	30		35	70	Examination and term work/Project
Chemical thermodynamics	BS/CCh	4	5	150	15	30		35	70	Examination and term work/Project
<b>Module 5. Operation of knowledge in the field of electrical engineering, electronics and information technology</b>										
Computer technologies in the energy sector	BS/CCh	3	5	150	15	15	15	35	70	Examination
Simulation of the electric	BS/CCh	3	5	150	15	15	15	35	70	Examination
Applied Electronics	BS/CCh	3	5	150	15	15	15	35	70	Examination
Electrical engineering and electronics	BS/CCh	3	5	150	15	15	15	35	70	Examination
Elements of computer graphics in technical physics	BS/CCh	3	5	150	15	15	15	35	70	Examination
Elements of computer graphics and CAD bases in technical physics	BS/CCh	3	5	150	15	15	15	35	70	Examination
<b>Module 6. Application of physical laws in educational, research and practical activities</b>										
Applied Optics	BS/CCh	3	3	90	15	15		20	40	Examination
Elementaric particle Physics	BS/CCh	3	3	90	15	15		20	40	Examination
Nuclear physics	BS/CCh	3	3	90	15	15		20	40	Examination
Introduction to Medical Physics	BS/CCh	4	5	150	15	30		35	70	Examination
Molecular Physics and Thermodynamics	BS/CCh	4	5	150	15	30		35	70	Examination
Applied Thermal Physics	BS/CCh	4	5	150	15	30		35	70	Examination
Manufacturing practice I	BS/US	4	5	150						Total mark on practice
Statistical physics and thermodynamics	BS/CCh	4	5	150	15	30		35	70	Examination
Neutron transport theory	BS/CCh	4	5	150	15	30		35	70	Examination
The nuclear and neutron physics	BS/CCh	4	5	150	15	30		35	70	Examination
Atomic physics	BS/CCh	5	5	150	15	30		35	70	Examination
Theoretical Foundations of spectrometry	BS/CCh	5	5	150	15	30		35	70	Examination
The physics of the atom and atomic phenomena	BS/CCh	5	5	150	15	30		35	70	Examination
Physics of the condensed state	BS/CCh	5	5	150	15	30		35	70	Examination
Physics of semiconductors and dielectrics	BS/CCh	5	5	150	15	30		35	70	Examination
Solid state physics	BS/CCh	5	5	150	15	30		35	70	Examination
Computational methods in quantum physics	BS/CCh	6	5	150	15	30		35	70	Examination

Quantum mechanics	BS/CCh	6	5	150	15	30		35	70	Examination
Quantum mechanics of molecules	BS/CCh	6	5	150	30	15		35	70	Examination
Introduction to scientific activity	AS/US	7	3	90	15	15		20	40	Examination
<b>Module 7. Using the legislative and regulatory framework to organize work in compliance with safety requirements</b>										
Applied physics and radiation safety	BS/CCh	5	5	150	15	15	15	35	70	Examination
Principles of nuclear safety	BS/CCh	5	5	150	15	15	15	35	70	Examination
Radioecology and radiation safety	BS/CCh	5	5	150	15	15	15	35	70	Examination
Information technology and tech-niques in engineering education	BS/CCh	6	5	150	15	30		35	70	Examination
Basics of modern energy in English	BS/CCh	6	5	150	15	30		35	70	Examination
Basics of Heat Transformation	BS/CCh	6	5	150	15	15	15	35	70	Examination
Manufacturing practice II	BS/US	6	5	150						Total mark on practice
Heat pumps	BS/CCh	6	5	150	15	15	15	35	70	Examination
Heat and mass transfer in power plants	BS/CCh	6	5	150	15	15	15	35	70	Examination
Formation of the technical thesaurus	BS/CCh	6	5	150	15	30		35	70	Examination
Basics cryosystems	AS/CCh	6	5	150	15	30		35	70	Examination
Processes and equipment of cooling gas	AS/CCh	6	5	150	15	30		35	70	Examination
Thermophysical processes in cryogenic systems	AS/CCh	6	5	150	15	30		35	70	Examination
Specifications and technical documentation on labor protection	BS/CCh	7	5	150	15	30		35	70	Examination
Occupational Safety and Health	BS/CCh	7	5	150	15	30		35	70	Examination
Occupational health and safety in the Technical Physics	BS/CCh	7	5	150	15	30		35	70	Examination
Spectrometry radiation and methods of recording radiation	BS/CCh	7	5	143	15	15	8	35	70	Examination
Physics of radiation protection	BS/CCh	7	5	143	15	15	8	35	70	Examination
Radiometry	AS/CCh	7	5	143	15	15	8	35	70	Examination
<b>Module 8. Establishment of calculation methods and selection of equipment for nuclear power, non-traditional and renewable energy</b>										
Alternative and renewable energy sources	AS/CCh	5	5	150	15	30		35	70	Examination
Energequipment NEI	AS/CCh	5	5	150	15	30		35	70	Examination and term work/Project
Nuclear research reactors	AS/CCh	6	5	150	15	15	15	35	70	Examination and term work/Project
ACS processes NPI	AS/CCh	7	5	150	15	30		35	70	Examination
Fundamentals of reactor physics	AS/CCh	7	5	150	15	30		35	70	Examination
Controlled thermonuclear fusion	AS/CCh	7	5	150	15	30		35	70	Examination
Nuclear fuel cycle	AS/CCh	7	6	180	15	30	15	40	80	Examination
<b>Module 9. Substantiation of calculation methods and selection of equipment for the production of cold, ventilation and air conditioning systems</b>										

Air conditioning and ventilation	AS/CCh	5	5	150	15	30		35	70	Examination
Chillers	AS/CCh	5	5	150	15	30		35	70	Examination
Refrigerators	AS/CCh	6	5	150	15	15	15	35	70	Examination and term work/Project
Automation of refrigeration	AS/CCh	7	5	150	15	30		35	70	Examination
Installation, diagnostics and repair of refrigeration equipment	AS/CCh	7	6	180	15	30	15	40	80	Examination
Bases for design and construction of refrigerating machines with elements of CAD	AS/CCh	7	5	150	15	30		35	70	Examination
The basic technology of production of consumers of artificial cold	AS/CCh	7	5	150	15	30		35	70	Examination
<b>Module 10. Conducting a feasibility study of the efficiency of energy systems in the field of high and low temperatures, energy-saving equipment</b>										
Economics of enterprise	BS/US	7	3	90	15	15		20	40	Examination
Prediploma practice	AS/CCh	8	15	450						Total mark on practice
Manufacturing practice III	AS/CCh	8	15	450						Total mark on practice
<b>Final examination</b>										
Diploma project		8	8	240						
Comprehensive exam		8	8	240						

**NON -PROFIT LIMITED COMPANY «SHAKARIM UNIVERSITY OF SEMEY**

**DEVELOPMENT PLAN FOR THE EDUCATIONAL PROGRAMME**

6B05303 – «Technical Physics»

for the years 2024-2028

Semey 2024



## Content

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# 1. 1. Passport of the Development Plan of the Bachelor's/Master's Program 6B05303 – « Technical Physics»

1	Basis for development	Development Program of Non-commercial joint-stock company «Shakarim university of Semey» for 2023-2029. School work plan
2	Implementation timeframe	2024-2028
3	Expected results of realization	<p>Demonstrate socio-cultural, economic-legal, environmental knowledge, communication skills, apply information technologies taking into account modern trends in the development of society.</p> <p>Apply laws and regulations in the areas of economics and law, ecology and life safety, as well as skills in entrepreneurship, leadership, and receptiveness to innovation.</p> <p>Apply basic knowledge in the field of mathematics and physics, methods of mathematical analysis and modeling, theoretical and experimental research in cognitive and professional activities.</p> <p>Apply the requirements of rules and documentation standards in educational, scientific and professional activities.</p> <p>Use the fundamental laws of mechanics, thermodynamics, heat and mass transfer and their practical applications.</p> <p>Operate with knowledge in the field of electrical engineering, measuring instruments, electronics and information technology in your subject area.</p> <p>Apply laws that describe the course of physical processes in the microcosm, the mathematical apparatus of non-relativistic quantum mechanics, methods for calculating the physical properties of materials, assessing the applicability of approximations in educational, research and practical activities.</p> <p>Use rules for organizing work in compliance with safety requirements based on the relevant legislative and regulatory framework in the field of labor protection, radiation safety, fire safety in the energy sector.</p>

		<p>Justify calculation methods and selection of equipment for the nuclear industry, non-traditional and renewable energy for the production of cold, ventilation and air conditioning systems based on the achievements of science and technology. Conduct feasibility studies on the efficiency of energy systems in the field of high and low temperatures, energy-saving equipment using the necessary materials from existing production facilities.</p>
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## **2. Analytical substantiation of the educational program**

### **2.1 Information about the educational program**

The educational program is designed in accordance with the National Qualifications Framework and professional standards, according to the Dublin Descriptors and the European Qualifications Framework. The typical duration of the Bachelor's degree program is 4 years.

The main criterion for the completion of the educational process is the mastering of at least 240 credits, with the awarding of the Bachelor of Engineering and Technology degree in the educational program 6B05303 – « Technical Physics ».

The educational program “Technical Physics” is aimed at training competitive specialists for work in the nuclear industry and low-potential technology, capable of quickly adapting to rapidly changing socio-economic conditions, as well as meeting the individual’s needs for comprehensive professional and intellectual development.

The preparation of bachelors in EP 6B05303 – “Technical Physics” is carried out by the Department of “Technical Physics and Thermal Power Engineering” of the Research School of Physical and Chemical Sciences.

### **2.2 Internal and external conditions of the educational program development**

Academic year Basis of learning	2024-2025 academic year	2025-2026 academic year	2026-2027 academic year	2027-2028 academic year
Grant	32	34	36	38
Contract	2	3	4	5
Total	34	37	40	43

### **2.3 Internal and external conditions of the educational program development**

The academic policy of the department “Technical Physics and Thermal Power Engineering”, which implements the EP “Technical Physics”, is aimed at the use of innovative teaching technologies based on the best practices of teaching modern general education, basic and major disciplines, on the quality of teaching using modern teaching strategies, modern teaching methods in higher school. Students and teaching staff of the Department of Technical Physics and Thermal Power Engineering have unlimited access to information and educational resources and electronic library systems necessary to carry out independent educational and research work.

The educational and laboratory classrooms of the Department of Technical Physics and Thermal Power Engineering are equipped with modern equipment and comply with current sanitary standards, fire safety requirements, and qualification requirements for the activities of educational organizations. These classrooms are used both for conducting classes in the disciplines of the EP “Technical Physics” and for students’ independent work, completing coursework and diploma projects. The EP “Technical Physics” is sufficiently provided with basic teaching materials for the disciplines taught.

The auditoriums of the Department of Technical Physics and Thermal Power Engineering are connected to the WI-FI network for holding online conferences, lectures, and seminars with the participation of leading scientists from Kazakhstan, near and far abroad. The educational resources portal of the Shakarim University of Semey is functioning (<http://ais.semgu.kz/>), which contains lectures, video materials, hyperlinks, tasks for self-testing, presentations on topics, tutorials and other educational and methodological content on the studied disciplines of the EP, the content of which the teaching staff applies in the classroom, and to which students have round-the-clock access. The most common innovative methods developed by teaching staff of departments for giving lectures, conducting practical and laboratory classes, defense and pre-defense of final works include: video lectures, presentation slides, working with an interactive whiteboard, using the graphic editor KOMPAS, AutoCAD, as well as for training, calculations and engineering calculations MathCAD.

The practice bases are:

- specialization “Engineering and physics of low temperatures” - food processing industry enterprises using artificial refrigeration, such as Semipalatinskorgtekhnik LLP, Kazpolygraf LLP, etc.
- specialization “Nuclear Reactors and Power Plants” - enterprises of the nuclear and nuclear industry, such as the National Nuclear Center of the Republic of Kazakhstan, the State Enterprise at the RPE “Center for Nuclear Medicine and Oncology of the City of Semey”, the RSE at the RPE “Institute of Nuclear Physics” in Almaty.

Practice bases are selected according to the following criteria:

- equipping enterprises with modern equipment;
- use of innovative technologies;
- compliance with the requirements of the safety instructions;
- environmental safety of the enterprise.

Practice bases meet the requirements and content of practice.

## **2.4 Information about the teaching staff implementing the educational program**

The teaching staff of the department “Technical Physics and Thermal Power Engineering”, ensuring the implementation of the EP “Technical Physics” is:

<b>№</b>	<b>Indicators</b>	<b>Unit</b>	<b>2024-2025 academic year</b>	<b>2025-2026 academic year</b>	<b>2026-2027 academic year</b>	<b>2027-2028 academic year</b>
1	Share of teaching staff with academic degrees in EP	%	<b>55</b>	<b>55</b>	<b>55</b>	<b>55</b>
2	Including the share of faculty members with a degree in general education disciplines cycle	%	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>

The Department of Technical Physics and Thermal Power Engineering carries out the educational process at three levels of study: bachelor's, master's and PhD doctoral studies. The formation of scientific and pedagogical personnel at the department is carried out through training through master's programs, PhD doctoral studies, and advanced training of teaching staff.

EP teachers undergo advanced training at leading universities in Kazakhstan (according to the FPK plan) and training seminars conducted by the Ministry of Education and Higher Education of the Republic of Kazakhstan, universities and other organizations. Teacher training is confirmed by certificates and certificates. The university teaching staff undergo scientific

internships at universities near and far abroad, at universities and research institutes of the Republic of Kazakhstan. The qualified staff of teachers is able to provide high-quality educational process, meets the qualification requirements, level and specifics of the educational program.

The teaching staff of the EP “Technical Physics” takes part in competitions for grant funding from the MN and VO RK. The scientific direction of the department is associated with research in the field of solving scientific and practical problems in various areas of energy. The teaching staff of the department has high scientific and methodological publication activity. The results of the scientific activities of teachers are reflected in scientific publications with an impact factor. Scientists of the Department of Technical Sciences and Technology have the Hirsch index (h-index) in the Web of Science and Scopus databases.

### **2.5 Characteristics of the educational program achievement**

In 2023, the EP “Technical Physics” successfully passed specialized accreditation with the Independent Agency for Accreditation and Expertise of Educational Quality (ARQA) for a period of 5 years (Registration number HE – SA – 000183 dated July 02, 2020).

### **3. Main objectives of the educational program development plan**

In accordance with the Strategic Development Plan of the University, the following tasks have been identified for the effective implementation of the EP “Technical Physics”

- Ensuring high-quality training of competitive specialists
- Development and implementation of scientific projects
- Development of human resources
- Strengthening the material and technical base
- Development of international cooperation

The expected final results include: participation in funded grant projects, publication activity of teaching staff in rating publications with a non-zero impact factor, development and operation of joint educational programs with foreign universities, implementation of scientific research results in the educational process, involvement of students in scientific research, academic mobility students and teaching staff.

#### 4. Risk analysis of the educational program

Identification and assessment of risks of the EP “Technical Physics” is carried out in accordance with the Strategic Development Plan of the NJSC Shakarim University of Semey for 2023-2029.

The mechanism for monitoring possible risks of the EP “Technical Physics” is surveys and surveys of students’ satisfaction with the organization of the educational process, the quality of teaching, and the material and technical base. In order to assess the quality of the implemented EP, meetings are held with specialists, graduates of previous years, and students. Employers' questionnaires are systematically monitored to assess the quality of specialist training. The results of the survey and monitoring of EP risks are analyzed and used in the future when updating educational programs.

№	Name of risks	Elimination measures
1	Decrease in the number of EP students	Strengthen career guidance work
2	Insufficient level of language knowledge to introduce trilingual education	Foreign language courses
3	Declining employment rate	Attracting employers, graduate fair
4	Insufficient development of external and internal academic mobility of students and teaching staff	Identification of universities for academic mobility and conclusion of agreements
5	The risk of reducing the degree of teaching staff in the EP	Increasing motivation to work at the university



### 5. Action plan for the development of the educational program

№	Criteria	Expected results	Unit	2024-2025		2025-2026		2026-2027		2027-2028	
				Plan	Actual implementation	Plan	Actual implementation	Plan	Actual implementation	Plan	Actual implementation
Orientation 1. Educational and methodological support											
1.1	Updating the educational program on the basis of professional standards taking into account employers' recommendations	Examination of the Educational Program 6B05303 – «Technical Physics» in order to increase the practice-orientedness and development of professional competencies of graduates	fact.	-		+		-		+	
1.2	Monitoring and updating catalogs of elective disciplines in accordance with the development of key and professional competencies, labor market demands	Improving the quality of the content of educational programs by including elective courses aimed at developing key and professional competencies of graduates in accordance with labor market demands.	fact.	+		-		-		-	
1.3	Introduction into the educational process of modern teaching technologies that contribute to the development of cognitive activity and communicative ability of students	Improving the quality of teaching academic disciplines, taking into account the novelty and variety of forms of work that contribute to the development of cognitive activity.	fact.	+		+		+		+	

<b>1.3.1</b>	Introduction into the educational process of massive open online courses (MOOCs) according to the educational program 6B05303 – «Technical Physics»	Introduction of disciplines into the educational process Improving the quality of teaching academic disciplines, taking into account the novelty and variety of forms of work that contribute to the development of cognitive activity.	unit.	-		-		1		1	
<b>1.4</b>	Involving social partners and employers in the development and examination of the implementation of educational programs	Improving the quality of implemented educational programs taking into account market demands and employer recommendations	unit.	2		2		2		2	
<b>1.5</b>	Development and implementation of elective courses in English	Introduction of disciplines in English into the educational process	unit.	-		-		1		1	
<b>1.6</b>	Conducting seminars and round tables on the use of innovative technologies in the educational process	Introduction of innovative technologies into the educational process	unit.	-		1		1		1	
<b>1.7</b>	Publication of educational, educational, methodological and scientific literature on implemented educational programs	Improving educational and methodological support in the disciplines of implemented educational programs	unit.	-		-		1		1	
<b>1.8</b>	Concluding agreements with foreign and domestic partner universities in order to develop academic exchange of students of all levels and teaching staff	Creation of a base of foreign and domestic universities - partners for the development of academic exchange of students of all levels and teaching staff	unit.	-		-		1		1	

<b>1.9</b>	Inviting students from partner universities to study for a semester, short-term internships, practice, etc.	Development of international recognition of educational programs, implementation of academic mobility programs for students	people.	-		-		1		1	
<b>1.10</b>	Participation of teaching staff and students in international academic exchange programs	Development of international cooperation with foreign universities implementing educational programs in Nuclear technology and engineering and low temperature physics	people.	-		-		1		1	
<b>1.11</b>	Development of outgoing academic mobility of teaching staff and students in the field of Nuclear technology and engineering and low temperature physics	Improving the educational program based on the experience of implementing similar programs in leading foreign universities	people.	-		-		1		1	
<b>Orientation 2. Teaching staff</b>											
<b>2.1</b>	Increasing the professional level and training of scientific and pedagogical personnel for the implementation of educational programs once every 5 years	The share of teaching staff who have undergone advanced training at the republican and international level is at least 20%	people.	2		2		2		2	
<b>2.2</b>	Completion of advanced training, retraining, internship of teaching staff at the international level	Completion of at least 2 teachers in advanced training, retraining, and internship programs for teaching staff at the international level	people.	2		2		2		2	

<b>2.3</b>	Promotion of publications of teaching staff works in international publications indexed by the Web of Science and Scopus databases	Increasing the share of teaching staff who have published the results of scientific research in publications indexed by the Web of Science and Scopus databases - at least 30% of the total number of teaching staff	%	30		30		30		30	
<b>2.4</b>	Involvement of practical specialists in teaching and scientific activities	Participation in the implementation of educational programs of practitioners (at least 20% of specialists)	%	20		20		20		20	
<b>Orientation 3. Internationalization of educational programs</b>											
<b>3.1</b>	Concluding agreements on international cooperation with foreign universities	Implementation of joint projects, preparation of scientific publications with foreign partners, creation of bases for scientific internships for students	unit.	-		-		1		1	
<b>3.2</b>	Attracting foreign students to study under the educational program 6B05303 – «Technical Physics»	Increase in the number of foreign students	people.	-		-		1		1	
<b>3.3</b>	Organization of joint scientific and practical activities with international partners	Improving the efficiency of scientific and scientific-methodological activities of teaching staff, exchange of experience with foreign partners	unit.	1		1		1		1	

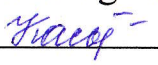
<b>3.4</b>	Expansion of cooperation with advanced foreign scientific and educational organizations in order to attract the most qualified foreign specialists to the implementation of educational programs	Formation of key and professional competencies in accordance with the practice of leading universities	unit.	1		-		1		1	
<b>3.5</b>	Expanding cooperation with leading foreign scientific and educational organizations in order to attract the most qualified foreign specialists to the implementation of educational programs	Formation of key and professional competencies in accordance with the practice of leading universities	people.	1		-		1		1	
<b>Orientation 4: Logistics and digitalization</b>											
<b>4.1</b>	Step-by-step equipping of classrooms with technical means of education (projectors, panels, interactive and multimedia boards, multifunctional devices, webcam, projector screen, etc.).	Equipping the classrooms assigned to the department with technical means of education (projectors, panels, interactive and multimedia boards, multifunctional devices, web camera, projector screen, etc.).	unit.	-		-		1		1	
<b>4.2</b>	Carrying out automation of the educational process (testing, session management, student contingent movement, dean's office, department, faculty workload, schedule, library, syllabus)	Information management based on the automation of the educational process (testing, session management, student contingent movement, dean's office, department, faculty workload, schedule, library, syllabus)	fact.	+		+		+		+	

4.3	Replenishment of the full-text database of the results of scientific research of faculty and students, teaching staff (articles, monographs, etc.).	Increase in the number of results of scientific works of scientists, research of faculty and students, teaching staff (articles, monographs, etc.).	unit.	5		5		5		5	
4.4	Expanding the collection of scientific and educational literature, including electronic media for the educational programs being implemented	Ensuring the implementation of educational programs on the basis of modern educational and information resources, including electronic media	%	10		10		10		10	
4.5	Monitoring of filling and improvement of the faculty website	Formation of the Faculty website on various aspects of the implementation of educational programs.	%	20		20		20		20	

Head of department  O.A. Stepanova

## REVIEWED

at the meeting of the Commission on Academic Quality  
of the Research School of Physical and Chemical Sciences  
Protocol of the meeting No. 1 dated 06.06.2024

Chairman  Kassymova Zh.S.

## AGREED

Dean  Kasymov A.B.  
06.06.2024