NJSC SHAKARIM UNIVERSITY OF SEMEY

EDUCATIONAL PROGRAM

8D05 - Natural Sciences, Mathematics and Statistics
(Code and classification of the field of education)

8D053 - Physical and chemical sciences
(Code and classification of the direction of training)

0530
(Code in the International Standard Classification of Education)

D090 Physics
(Code and classification of the educational program group)

8D05302 - Technical Physics
(Code and name of the educational program)

Doctor of philosophy (PhD)
(Level of preparation)

Semey

Educational program

8D05 -- Natural Sciences, Mathematics and Statistics
(Code and classification of the field of education)

8D053 - Physical and chemical sciences
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0530
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D090 - D090 Physics
(Code and classification of the educational program group)

8D05302 - Technical Physics
(Code and name of the educational program)

Doctor of philosophy (PhD)
(Level of preparation)

Semey 2024

PREFACE

Developed

The educational program 8D05302 - Technical Physics in the direction of preparation 8D053 - 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	Kassymov Askar	Dean Research School of Physical and Chemical Sciences
Educational program manager	Stepanova Olga	Head of the Department of Technical Physics and Thermal Power Engineering
Member of the AC	Yermolenko Mikhail	Senior Lecturer of the Department of Technical Physics and Thermal Power Engineering
Member of the AC	Vityuk Vladimir	Deputy Director General for Science (National Nuclear Center of the Republic of Kazakhstan)
Member of the AC	Chektybayev Baurzhan	Head of Thermonuclear Studies Department of IAE RSE NNC RK
Member of the AC	Irkimbekov Ruslan	Head of the Laboratory of Thermophysical and Neutronic Characteristics of Irradiating Devices, Branch of the IAE RSE NNC RK
Member of the AC	Tulenbergenov Timur	PhD student of group DTF-201
Member of the AC	Kelsingazina Ruziya	PhD student of group DTF-201.1

Reviewing

Full name of the reviewer	Position, place of work
Mukhamedov Nurzhan	Head of Reactor Fuel Laboratory, Institute of Atomic Energy of National Nuclear Center of the Republic of Kazakhstan
Kakimzhanov Dauir	Director of «PlasmaScience» LLP

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.

Content

1.Introduction

1.1.General data

Training under the educational program 8D05302 Technical Physics is carried out at the Department of Technical Physics and Heat Power Engineering of the Research School of Physical and Chemical Sciences.

The educational program for the preparation of a Doctor of Philosophy (PhD) has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in- depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere. During the implementation of the educational program, the features of training specialists characteristic of the Shakarim University of the city of Semey and the region were taken into account.

The uniqueness of this educational program lies in the fact that the training of specialists in this field is carried out in close cooperation with the National Nuclear Center of the Republic of Kazakhstan and the Center for Nuclear Medicine and Oncology of the city of Semey.

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 criterion for the completion of the educational process for the preparation of PhD doctors is the student`s mastering of at least 45 credits of theoretical education, as well as at least 123 credits of doctoral student`s research work, including internship and doctoral dissertation, at least 12 credits for writing and defending a doctoral dissertation.

1.3.Typical study duration: 3 years.

2.PASSPORT OF THE EDUCATIONAL PROGRAM

2.1.EP purpose	Training of highly qualified personnel in the field of technical physics with advanced professional, research and management competencies for a successful career in the academic community, public administration and industry.
2.2.Map of the training profile within the educational program	
Code and classification of the field of education	8D05 - Natural Sciences, Mathematics and Statistics
Code and classification of the direction of training	8D053 - Physical and chemical sciences
Code in the International Standard Classification of Education	0530
Code and classification of the educational program group	D090 - D090 Physics
Code and name of the educational program	8D05302 - Technical Physics
2.3.Distinctive features of the OP (double degree/joint, OVPO-partner, Double major, innovative)	No
2.4.Qualification characteristics of the graduate	
Degree awarded / qualification	PhD in the educational program 8D05302 «Technical physics»
Name of professional standard	"Teacher (faculty) of organizations of higher and (or) postgraduate education".
Atlas of new professions	Not available
Regional standard	Not available
Name of the profession / list of positions of a specialist	Engineer-physicist, specialist of higher, I and II categories, junior researcher, researcher, lecturer of special disciplines of the course of technical physics in higher educational institutions.
OQF qualification level (industry qualification framework)	8
Area of professional activity	Industry, energy, education, science, medicine
Object of professional activity	Enterprises and firms of energy and technological profiles. Research institutions. Medical institutions. Higher and secondary specialized educational institutions. Akimats and ministries.
Types of professional activity	Research and innovation activities. Organizational and managerial activities. Educational (pedagogical) activity.
2.5.Graduate Model	Use the possibilities of written communication in the academic and scientifc and technical felds when writing research papers and conducting classes. Interpret the results of the study and the limits of their application. Interpret the physical essence of the phenomena and processes of heat transfer in scientifc creativity and professional activities. Form a scientifc approach in the creation of new generation nuclear reactors. Substantiate modern approaches to the issue of

	radiation safety within the framework of legislation and research activities. Form a scientifc approach in matters of statistical physics and thermodynamics of irreversible processes. Structure the information on the problems of thermophysics of materials in research activities. Form a scientifc approach in the feld of radiation protection and control of nuclear materials. Develop modern approaches to the issues of physical research using information technologies.

3.Modules and content of the educational program

Research in scientific and pedagogical activities

Brief description of the module content

The module deals with the organization of research and the culture of presentation of scientific and technical information.

Module disciplines

Statistics and experimental design using R

Academic writing

Research methods

Research work of the doctoral student, including internship and doctoral dissertation I

Research work of the doctoral student, including internship and doctoral dissertation II

Pedagogical practice

The physical essence of phenomena and processes in technical physics

Brief description of the module content

The module examines modern aspects of fundamental physics in the study of processes in various systems

Module disciplines

Thermodynamics, statistical physics

Information and measuring systems and technologies in thermal physics

Methods and procedures for accounting and control of nuclear material

Theory of protection against ionizing radiation

Thermophysical properties of materials

Thermodynamics of irreversible processes

Nuclear fuel cycle of a new generation

Research work of the doctoral student, including internship and doctoral dissertation III

Research work of the doctoral student, including internship and doctoral dissertation IV

Research practice

Research work of the doctoral student, including internship and doctoral dissertation V

Research work of the doctoral student, including internship and doctoral dissertation VI

Final attestation

Brief description of the module content

Writing and defending a doctoral dissertation.

Module disciplines

Doctoral dissertation

4.Summary table on the scope of the educational program

«8D05302 - Technical Physics»

Name of discipline	Cycle/ Component	Term	Number of credits	Total hours	Lec	SPL	LC	IWST	IWS	Knowledge control form
Research in scientific and pedagogical activities										
Statistics and experimental design using R	BS/US	1	3	90	15	15		20	40	Examination
Academic writing	BS/CC	1	5	150	15	30		35	70	Examination
Research methods	BS/US	1	5	150	30	15		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation I	AS/US	1	15	450						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation II	AS/US	2	20	600						Total mark on practice
Pedagogical practice	BS/US	3	10	300						Total mark on practice
The physical essence of phenomena and processes in technical physics										
Thermodynamics, statistical physics	BS/US	1	5	150	30	15		35	70	Examination
Information and measuring systems and technologies in thermal physics	AS/CCh	2	5	150	30	15		35	70	Examination
Methods and procedures for accounting and control of nuclear material	AS/CCh	2	5	150	30	15		35	70	Examination
Theory of protection against ionizing radiation	AS/CCh	2	5	150	30	15		35	70	Examination
Thermophysical properties of materials	AS/CCh	2	5	150	30	15		35	70	Examination
Thermodynamics of irreversible processes	AS/CCh	2	5	150	30	15		35	70	Examination
Nuclear fuel cycle of a new generation	AS/CCh	2	5	150	30	15		35	70	Examination
Research work of the doctoral student, including internship and doctoral dissertation III	AS/US	3	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation IV	AS/US	4	30	900						Total mark on practice
Research practice	AS/US	5	10	300						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation V	AS/US	5	20	600						Total mark on practice
Research work of the doctoral student, including internship and doctoral dissertation VI	AS/US	6	18	540						Total mark on practice
Final attestation										
Doctoral dissertation		10	12	360						

ON -PROFIT LIMITED COMPANY «SHAKARIM UNIVERSITY OF SEMEY

DEVELOPMENT PLAN FOR THE EDUCATIONAL PROGRAMME
8D05302 – «Technical Physics»

for the years 2024-2027

Semey 2024

Content

1. Passport of the Development Plan of the Bachelor's/Master's Program 8D05302 – « Technical Physics»

1	Basis for development	Development program of the Non -Profit Limited Company «Shakarim University of Semey» for 2023-2029.. School work plan
2	Implementation timeframe	2024-2027
3	Expected results of realization	Mastering by doctoral students an extensive knowledge base in the field of technical physics, as well as advanced scientific research that prepares them for a successful scientific career in academic, government or industrial circles

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 3 years.

The main criterion for the completion of the educational process is the development of at least 180 credits, with the award of a PhD degree

Training in the educational program 8D05302 - Technical Physics is carried out at the Shakarim University of Semey at the Department of Technical Physics and Thermal Power Engineering. During the implementation of the educational program, the peculiarities of training characteristic of the Shakarim University of Semey are taken into account. The uniqueness of this educational program lies in the fact that the training of specialists in this field is carried out in close cooperation with the National Nuclear Center of the Republic of Kazakhstan and the Center for Nuclear Medicine and Oncology of Semey city. Assessment of the quality of training of future specialists in the framework of defending dissertations is carried out at field meetings of the attestation commission on the basis of the branch of the department in the National Research Center of the Republic of Kazakhstan (Kurchatov).

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
Grant	5	5	5
Contract			
Total	5	5	5

2.3 Internal and external conditions of the educational program development

The academic policy of the Department of Technical Physics and Thermal Power Engineering, which implements OP 8D05302 "Technical Physics", is aimed at using innovative teaching technologies based on best practices in teaching basic and core disciplines, on the quality of teaching using modern learning strategies, modern teaching methods in higher education. Doctoral 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 for 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, comply with current sanitary standards, fire safety requirements, and qualification requirements for the activities of educational organizations. Some of the disciplines are held on the basis of the branch of the department at the RSE National Nuclear Center of the Republic of Kazakhstan.

The classrooms of the Department of Technical Physics and Thermal Power Engineering are connected to a WI-FI network for online conferences, lectures, seminars with the participation of leading scientists from Kazakhstan, near and far abroad. The Portal of educational resources of the Shakarim Semey University is functioning (http://ais.semgu.kz /), which contains lectures, videos, hyperlinks, tasks for self-examination, presentations on topics, textbooks and other educational and methodological content on the studied disciplines of the OP, the content of which the teaching staff uses in the classroom, and to which students have round-the-clock access.

The practice bases meet the requirements and content of the practice.

The department carries out work on funded projects:

AP13068365 Development of resource-saving method of surface hardening of working bodies of soil tillage machines (74221878 tng.);

AP13068529 Development of technology of electron-beam modification of polymeric materials used in mechanical engineering (73941056 tng.);

AP13068451 Preparation of multifunctional calcium-phosphate coatings with titanium dioxide nanoparticles by plasma-electrolytic oxidation (74405400 tng.);

AP14871373 Development of supersonic arc metallization technology for restoration of worn surfaces of crankshafts of internal combustion engines (76840457 tng.);

AP23489446 Improving the efficiency of hybrid solar collectors using nanomodified phase transition materials (79,005,621 tng.).

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:

№	Indicators	Unit	2024-2025 academic year	2025-2026 academic year	2026-2027 academic year
1	Share of teaching staff with academic degrees in EP	%	**100**	**100**	**100**
2	Including the share of faculty members with a degree in general education disciplines cycle	%	**100**	**100**	**100**

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

OP teachers undergo advanced training in leading universities of Kazakhstan (according to the FPC plan) and training seminars held by the Ministry of Education and Science of the Republic of Kazakhstan, universities and other organizations.

The Faculty of Technical Physics takes part in competitions for grant financing, program-targeted financing of projects, the administrator of which are the Ministry of Education and Science of the Republic of Kazakhstan, development institutes. The scientific direction of the department is related to research in the field of solving scientific and practical problems in various areas of energy. The teaching staff of the department has a high scientific and methodological publication activity. The results of the scientific activity of teachers are reflected in scientific publications with an impact factor. Scientists of the TFiTE department have the Hirsch index (h-index) in the Web of Science and Scopus databases.

2.5 Characteristics of the educational program achievement

OP "Technical Physics" in 2020 successfully passed specialized accreditation in the ARQA agency for a period of 5 years (Registration number HE – SA – 000185 dated July 02, 2020).

Doctoral students of the educational program are members of working groups that carry out grant financing projects, and are also winners of various scientific competitions.

3. Main objectives of the educational program development plan

In accordance with the Strategic Development Plan of the University, the following tasks are defined for the effective implementation of OP 8D05302 "Technical Physics":

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

4. Risk analysis of the educational program

The mechanism for monitoring possible risks of OP 8D05302 "Technical Physics" is surveys and questionnaires of students with satisfaction with the organization of the educational process, the quality of teaching, and the material and technical base. The questionnaires of employers are systematically monitored, which assess the quality of training of specialists. The results of the survey and risk monitoring are analyzed and used in the future when updating educational programs.

№	Name of risks	Elimination measures
1	Decrease in the number of students enrolled in the OP	To strengthen career guidance among graduates of the Master's degree
2	Insufficient development of external and internal academic mobility of students and teaching staff	Identification of directions for academic mobility of doctoral students and conclusion of contracts
3	Changing the needs and priorities of students	Increasing the level of material and technical equipment of the department and increasing the prestige of postgraduate education on the part of employers
4	Low for the defense of doctoral dissertations	Strengthen measures of scientific support for doctoral students

5. Action plan for the development of the educational program

№	Criteria	Expected results	Unit	2024-2025		2025-2026		2026-2027	
				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 «Technical Physics» in order to increase the practice-orientedness and development of professional competencies of graduates	fact.	When changing the standard		When changing the standard		When changing the standard	
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.	At the request of employers		At the request of employers		At the request of employers	

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.	+		+		+	
1.3.1	Introduction into the educational process of massive open online courses (MOOCs) according to the educational program «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	
1.4	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	
1.5	Development and implementation of elective courses in English	Introduction of disciplines in English into the educational process	unit.	-		-		-	
1.6	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	

1.7	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	
1.8	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	
1.9	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	
1.10	Participation of teaching staff and students in international academic exchange programs	Development of international cooperation with foreign universities implementing educational programs in the field of Technical Physics	people.	-		-		-	
1.11	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.	-		-		-	
Orientation 2. Teaching staff									

2.1	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.	1		1		1	
2.2	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	
2.3	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	
2.4	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	
Orientation 3. Internationalization of educational programs									
3.1	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	
3.2	Attracting foreign students to study under the educational program «Technical Physics»	Increase in the number of foreign students	people.	-		-		-	

3.3	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	
3.4	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	
3.5	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	
Orientation 4: Logistics and digitalization									
4.1	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	

4.2	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	
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	
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	

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