NJSC SHAKARIM UNIVERSITY OF SEMEY

EDUCATIONAL PROGRAM

7M07 - Engineering, Manufacturing and Civil engineering
(Code and classification of the field of education)

7M071 - Engineering and engineering trades
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

M098 - Heat Power Engineering
(Code and classification of the educational program group)

7M07101 - Heat Power Engineering
(Code and name of the educational program)

Master
(Level of preparation)

Semey

Educational program

7M07 -- Engineering, manufacturing and construction industries
(Code and classification of the field of education)

7M071 - Engineering and Engineering affairs
(Code and classification of the direction of training)

0710
(Code in the International Standard Classification of Education)

M098 - Heat Power Engineering
(Code and classification of the educational program group)

7M07101 - Heat Power Engineering
(Code and name of the educational program)

Master
(Level of preparation)

Semey 2024

PREFACE

Developed

The educational program 7M07101 - Heat Power Engineering in the direction of preparation 7M071 - Engineering and Engineering affairs 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	Candidate of technical sciences, senior lecturer of the Department of Technical Physics and Thermal Power Engineering
Member of the AC		Head of the Thermal Power Plant-1 of the Stat-Owned Enterprise Teplokommunenergo of the city of Semey
Member of the AC	Chektybayev Baurzhan	Head of Thermonuclear Studies Department of IAE RSE NNC RK
Member of the AC	Mukhamedov Nurzhan	Head of the Department for Development and Testing of Reactor Devices of the Branch of the IAE RSE NNC RK
Member of the AC	Kusain Almira	Master s student of the group MTE-301
Member of the AC	Manuylenko Anton	Master s student of the group MTE-301

Reviewing

Full name of the reviewer	Position, place of work
Irkimbekov Ruslan	Head of the Laboratory of Thermophysical and Neutronic Characteristics of Irradiating Devices, Branch of the IAE RSE NNC RK
Zhumagazhinov Askar	Lead Engineer of the State-Owned Enterprise «Teplokommunenergo»

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 in the educational program 7M07101- Heat Power Engineering is carried out at the Shakarim State University of Semey at the Department of “Technical Physics and Heat Power Engineering” of the Research School of Physical and Chemical Sciences. The implementation of the educational program considers the particularity of the training of undergraduates, typical for the Shakarim State University of Semey and for the local region.

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 masters of the scientific and pedagogical direction is the development of at least 88 credits of theoretical training, including 6 credits of pedagogical practice, 13 credits of research practice, as well as at least 24 credits of research work of a master`s student, including internships and the completion of a master`s thesis, at least 8 credits of the final attestations . A total of 120 credits.

1.3.Typical study duration: 2 years

2.PASSPORT OF THE EDUCATIONAL PROGRAM

2.1.EP purpose	Preparation of competitive specialists with deep modern knowledge in the field of heat power engineering, including in the fuel and energy sector, in the field of production, transformation and transportation of thermal energy
2.2.Map of the training profile within the educational program	
Code and classification of the field of education	7M07 - Engineering, manufacturing and construction industries
Code and classification of the direction of training	7M071 - Engineering and Engineering affairs
Code in the International Standard Classification of Education	0710
Code and classification of the educational program group	M098 - Heat Power Engineering
Code and name of the educational program	7M07101 - Heat Power Engineering
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	Master of Technical Sciences under the educational programme 7M07101-Heat Power Engineering
Name of professional standard	"Commissioning of heat supply systems". "Operation of heat supply systems". "Radiation monitoring". "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	Design engineer, junior researcher, senior laboratory assistant, teacher at college or university.
OQF qualification level (industry qualification framework)	7
Area of professional activity	Industry, energy industry, education, science.
Object of professional activity	Factors and firms of energy and technological profiles. Research institutions. Higher and secondary specialized educational institutions. Design institutes.
Types of professional activity	Scientific research. Production and technology. Organization and management. Operation. Project-based. Education (pedagogical).
2.5.Graduate Model	Apply fundamental scientifc, pedagogical, managerial, communicative knowledge and skills in professional activities. To form the strategy and structure of the organization of scientifc research and mathematical modeling of thermal power facilities. To operate with the necessary calculation methods of cogeneration and ventilation heat technology plants.

	To develop measures for safe operation and research on modern NPPs, engineering networks and equipment. To evaluate traditional and non-traditional energy conversion methods. To develop schemes for modern heat and nanotechnology plants. To consider the thermophysics of phase transformations and material properties. To justify methods for measuring emissions and material properties for modern nuclear energy. To develop innovations in heat and power engineering and cryogenic engineering. To outline the problems and prospects for the development of heating and cooling equipment.

3.Modules and content of the educational program

Sociolinguistic and scientific-pedagogical activity

Brief description of the module content

Promotes the formation of sociolinguistic competence and the application of fundamental scientific, pedagogical, managerial, communication knowledge and skills in professional activities.

Module disciplines
Foreign language (professional)

History and philosophy of science

Higher Education Pedagogy

Psychology of management

Pedagogical practice

Модуль 2.Organization of scientific research and mathematical modeling of heat and power facilities

Brief description of the module content

This module includes the study of the organization and conduct of scientific research in the field of energy. CAD issues in the field of high and low temperatures are considered.

Module disciplines
Information systems in heat power engineering and thermo technologies

Scientific research methodology

Organization and planning of scientific research

Basic scientific research

Basics of CAD low potential energy

DBMS

Theory and Techniques of a scientific experiment

Theory and technique of heating experiment

Experimental methods of physics research

Модуль 3. Calculation methods of cogeneration and ventilation heat technology plants

Brief description of the module content

This module reveals the modern problems of heat power engineering and heat technology.

Module disciplines
Alternative energy sources

High temperature thermal technological installation

Measurement of thermophysical properties of materials

Methods of thermal calculation

The research work of a student, including an internship and the implementation of a master s thesis I

Scientific and technical problems in heat power engineering and thermo technologies

Basics of cogeneration

Basics of nanotechnology

Industrial ventilation

Modern methods of energy conversion

Phase transformations

Safe operation and research activities in nuclear power plants, engineering networks and equipment

Brief description of the module content

This module examines radiation safety in nuclear energy, issues of operation of engineering systems and the development of waste-free production.

Module disciplines
Atomic power stations

Engineering systems, networks and equipment

Innovative heat technologies in heat power engineering

Cryogenic technique

Methods of measurement of ionizing radiation and the properties of nuclear materials

The research work of a student, including an internship and the implementation of a masters thesis II

Fundamentals of radiation safety

Perspectives and heat physics problems of heat refrigerants technique

Systems of low temperature thermal technology

Modern methods of processing organic fuel

Modern ways of development of nuclear energy

Modern technologies of use of secondary energy resources

Using heat and gas refrigeration machines

Research practice

The research work of a student, including an internship and the implementation of a masters thesis III

Final assessment

Brief description of the module content

Writing and defending a master`s thesis.

Module disciplines

Master`s dissertation

4.Summary table on the scope of the educational program

«7M07101 - Heat Power Engineering»

Name of discipline	Cycle/ Component	Term	Number of credits	Total hours	Lec	SPL	LC	IWST	IWS	Knowledge control form
Sociolinguistic and scientific-pedagogical activity										
Foreign language (professional)	BS/US	1	3	90		30		20	40	Examination
History and philosophy of science	BS/US	1	5	150	15	30		35	70	Examination
Higher Education Pedagogy	BS/US	1	3	90	15	15		20	40	Examination
Psychology of management	BS/US	1	3	90	15	15		20	40	Examination
Pedagogical practice	BS/US	3	6	180						Total mark on practice
Модуль 2.Organization of scientific research and mathematical modeling of heat and power facilities										
Information systems in heat power engineering and thermo technologies	BS/CCh	1	5	150	15	30		35	70	Examination
Scientific research methodology	BS/CCh	1	5	150	15	30		35	70	Examination
Organization and planning of scientific research	BS/CCh	1	5	150	15	30		35	70	Examination
Basic scientific research	BS/CCh	1	5	150	15	30		35	70	Examination
Basics of CAD low potential energy	BS/CCh	1	5	150	15	30		35	70	Examination
DBMS	BS/CCh	1	5	150	15	30		35	70	Examination
Theory and Techniques of a scientific experiment	BS/CCh	1	5	150	15	15	15	35	70	Examination
Theory and technique of heating experiment	BS/CCh	1	5	150	15	15	15	35	70	Examination
Experimental methods of physics research	BS/CCh	1	5	150	15	15	15	35	70	Examination
Модуль 3. Calculation methods of cogeneration and ventilation heat technology plants										
Alternative energy sources	AS/CCh	2	5	150	15	30		35	70	Examination
High temperature thermal technological installation	AS/CCh	2	5	150	15	30		35	70	Examination
Measurement of thermophysical properties of materials	AS/CCh	2	5	150	30	15		35	70	Examination
Methods of thermal calculation	AS/CCh	2	5	150	30	15		35	70	Examination
The research work of a student, including an internship and the implementation of a master s thesis I	AS/US	2	11	330						Total mark on practice
Scientific and technical problems in heat power engineering and thermo technologies	AS/US	2	5	150	30	15		35	70	Examination
Basics of cogeneration	AS/CCh	2	5	150	15	30		35	70	Examination
Basics of nanotechnology	AS/CCh	2	5	150	15	30		35	70	Examination
Industrial ventilation	AS/CCh	2	5	150	15	30		35	70	Examination
Modern methods of energy conversion	AS/CCh	2	5	150	15	30		35	70	Examination

Phase transformations	AS/CCh	2	5	150	30	15		35	70	Examination
Safe operation and research activities in nuclear power plants, engineering networks and equipment										
Atomic power stations	AS/CCh	3	5	150	15	30		35	70	Examination
Engineering systems, networks and equipment	AS/CCh	3	5	150	15	30		35	70	Examination
Innovative heat technologies in heat power engineering	AS/CCh	3	5	150	15	30		35	70	Examination
Cryogenic technique	AS/CCh	3	5	150	15	30		35	70	Examination
Methods of measurement of ionizing radiation and the properties of nuclear materials	AS/CCh	3	5	150	30	15		35	70	Examination
The research work of a student, including an internship and the implementation of a masters thesis II	AS/US	3	4	120						Total mark on practice
Fundamentals of radiation safety	AS/CCh	3	5	150	30	15		35	70	Examination
Perspectives and heat physics problems of heat refrigerants technique	AS/CCh	3	5	150	15	30		35	70	Examination
Systems of low temperature thermal technology	AS/CCh	3	5	150	30	15		35	70	Examination
Modern methods of processing organic fuel	AS/CCh	3	5	150	30	15		35	70	Examination
Modern ways of development of nuclear energy	AS/CCh	3	5	150	30	15		35	70	Examination
Modern technologies of use of secondary energy resources	AS/CCh	3	5	150	30	15		35	70	Examination
Using heat and gas refrigeration machines	AS/CCh	3	5	150	30	15		35	70	Examination
Research practice	AS/US	4	13	390						Total mark on practice
The research work of a student, including an internship and the implementation of a masters thesis III	AS/US	4	9	270						Total mark on practice
Final assessment										
Master`s dissertation		4	8	240						

ON -PROFIT LIMITED COMPANY «SHAKARIM UNIVERSITY OF SEMEY

DEVELOPMENT PLAN FOR THE EDUCATIONAL PROGRAMME
7M07101 – «Heat Power Engineering»

for the years 2024-2026

Semey 2024

Content

1. Passport of the Development Plan of the Bachelor's/Master's Program 7M07101 – «Heat Power Engineering»

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	2024-2026
3	Expected results of realization	Training of competitive specialists with in-depth modern knowledge in the field of thermal energy, including in the fuel and energy sector, in the field of production, transformation and transportation of thermal energy.

2. Analytical substantiation of the educational program

2.1 Information about the educational program

The educational program has been developed in accordance with the National Qualifications Framework and Professional Standards, according to the Dublin Descriptors and the European Qualifications Framework. The typical period for mastering the Master's degree program is 2 years.

The main criterion for the completion of the educational process is the development of at least 120 credits, with the award of a degree Master of Technical Sciences .

During the implementation of the educational program, the peculiarities of the preparation of undergraduates characteristic of Shakarim University and the region are taken into account

2.2 Internal and external conditions of the educational program development

Academic year / Basis of learning	2024-2025 academic year	2025-2026 academic year
Grant	5	5
Contract	2	2
Total	7	7

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 the OP Teploenergetika, 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. Undergraduates 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, comply with current sanitary standards, fire safety requirements, and qualification requirements for the activities of educational organizations.

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

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

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 staff of the OP Teploenergetika participates 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 Webofsciences and Scopus databases.

2.5 Characteristics of the educational program achievement

In 2020, OP Teploenergetika successfully passed specialized accreditation with the ARQA agency for a period of 5 years (Registration number HE – SA – 000197 dated July 02, 2020).

Undergraduates of the educational program are winners of scientific competitions.

3 Main objectives of the educational program development plan

The following tasks are defined for the effective implementation of the OP "Teploenergetika":

- 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 Teploenergetika 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	Strengthen career guidance work
2	Insufficient development of external and internal academic mobility of students and teaching staff	Identification of universities for academic mobility of undergraduates and conclusion of contracts
3	The risk of reducing the stability of the PPP in the PLO	To work out a system of support and stimulation of teaching staff
4	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.

5. Action plan for the development of the educational program

№	Criteria	Expected results	Unit	2024-2025		2025-2026	
				Plan	Actual implementation	Plan	Actual implementation
Direction 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 «Heat Power Engineering» in order to increase the practice-orientedness and development of professional competencies of graduates	fact.	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	
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 6B07103 – «Heat Power Engineering»	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.	-		-	
1.4	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	
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	
1.7	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.	-		-	
1.9	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.	-		-	

1.10	Participation of teaching staff and students in international academic exchange programs.	Development of international cooperation with foreign universities implementing educational programs in energy	people.	-		-	
1.11	Development of outgoing academic mobility of teaching staff and students in the field of energy	Improving the educational program based on the experience of implementing similar programs in leading foreign universities	people.	-		-	
Direction 2. Faculty							
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	
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	
2.3	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	
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	
Direction 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.	-		-	

3.2	Attracting foreign students to study under the educational program «Heat Power Engineering»	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	
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	people.	-		1	
Direction 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.	-		-	
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	
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	
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	

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