

MINISTRY OF EDUCATION AND SCIENCE
OF UKRAINE
UKRAINIAN STATE UNIVERSITY OF
RAILWAY TRANSPORT

APPROVED

Minutes of the meeting of the
Academic Council of the Ukrainian
State University of Railway
transportation

May 29, 2018, No. 5

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of the meeting of the Academic
Council of the Ukrainian State
University of Railway
transportation

" 24 " March 2022 № 2

Put into effect
from the 2022/2023 academic year

Rector
_____ S.V. Panchenko

**EDUCATIONAL AND PROFESSIONAL
PROGRAM**

ENERGY MANAGEMENT

Level of higher education:	second
Degree of higher education:	master
Field of knowledge:	14 Electrical engineering
Specialization:	144 Heat and power engineering

Kharkiv - 2022.

1. Preamble

The Law of Ukraine "On Higher Education" stipulates that:

1) educational and professional program - a single set of educational components (academic disciplines, individual tasks, practices, control measures, etc.) aimed at achieving the learning outcomes provided for by such a program, which gives the right to obtain a certain educational or educational and professional qualification(s);

2) The higher education standard defines the following requirements for the educational program:

the amount of ECTS credits required to obtain the relevant higher education degree;

requirements for the level of education of persons who can start studying under this program and their learning outcomes;

a list of mandatory graduate competencies;

the normative content of higher education training, formulated in terms of learning outcomes;

forms of certification of higher education students;

requirements for the creation of educational programs in a field of knowledge, two fields of knowledge or a group of specialties (in the standards of the junior bachelor's degree), interdisciplinary educational and scientific programs (in the standards of the master's degree and doctorate);

requirements of professional standards (if any);

3) The educational program should include:

a list of educational components and their logical sequence;

requirements for the level of education of persons who can start studying under this program;

the number of ECTS credits required to complete this program, as well as the expected program learning outcomes (competencies) that a higher education student must master;

4) higher education institution on the basis of the relevant educational program develops a curriculum that defines the list and scope of educational components in ECTS credits, their logical sequence, forms of organization of the educational process, types and scope of classes, schedule of the educational process, forms of current and final control that ensure the achievement of program learning outcomes by the applicant for the relevant degree of higher education. On the basis of the curriculum, individual curricula for each academic year are developed and approved for each higher education student in accordance with the procedure established by the higher education institution.

Educational and professional program "Energy Management" in the revised version after revision:

1) developed on the basis of the draft Standard of higher education of the second (master's) level in the specialty 144 Heat and Power Engineering, field of knowledge 14 Electrical Engineering by the working group of the Department of Heat Engineering, Thermal

of Engines and Energy Management of the Ukrainian State University of Railway Transport as part of the Institute:

RARELY Igor Alexandrovich	Professor of the Department of Heat Engineering, Thermal Engines and Energy Management, Doctor of Engineering, Team Leader;
KAGRAMANIAN Artur Oleksandrovych	- Associate Professor of the Department of Heat Engineering, Thermal Engines and Energy Management, Ph;
VASILENKO Oleg Vadymovych	- Acting Head of the Department of Heat Engineering, Thermal Engines and Energy Management, D. in Engineering;
WHITE Anna Vladimirovna	- Associate Professor of the Department of Heat Engineering, Thermal of engines and energy management, Ph.
involving and taking into account the positions and needs of such stakeholders:	
PIPE Evgeny Ivanovich	- Deputy Head of the Department energy management of JSC "Ukrzaliznytsia";
KALASHNIKOV Ivan Vladimirovich	- Acting First Deputy of the Kharkiv Branch of the Design and Research Institute of Railway Transport of JSC "Ukrzaliznytsia;
SUPPORT Andrey Ivanovich	- Head of Energy Management Department of the regional branch "Southern Railway" JSC "Ukrzaliznytsia;
KOZLOV Vladislav Vitalievich	- 1st year student (second (master's) level) of an educational and professional program "Energy Management, specialty 144 - Heat and Power Engineering

2) approved at the meeting:
of the Department of Heat Engineering, Thermal Engines and Energy Management dated December 27, 2021 (Minutes No. 6);
scientific and methodological commission of the Mechanical
and Energy faculty from
"January 24, 2022 (Minutes No. 7);
of the Academic Council of the Faculty of Mechanics and Energy dated
January 21, 2022 (Minutes No. 6);

3) approved at the meeting of the academic of the
Academic Council of the Ukrainian State University of Railway Transport dated
March 24, 2022 (Minutes No. 2).

2. Profile of the educational and professional program "Energy Management"

2.1. General characteristics

Level of higher education	Second (master's) level
Degree of higher education	Master
Field of expertise	14 Electrical engineering
Specialty.	144 Heat and power engineering
Restrictions on forms of education	There are no restrictions
Educational qualification	Master's degree in energy management
Qualification in the diploma	Degree (level) of higher education - Master's Degree Specialty - 144 Heat power engineering Educational and professional program - Energy management
Description of the subject area	<p><i>Objects of study and activity:</i> heat and power equipment for energy, industry, and municipal facilities; heat and cold supply systems; non-traditional (alternative) energy generation technologies; energy metering, regulation, and automation systems; design tools for heat and power plants and systems; energy management and audit.</p> <p><i>Objectives of the educational and professional program:</i> training of specialists in modern methods and means of energy audit of energy facilities, implementation of energy management systems, analysis, synthesis, design, adjustment, modernization and operation of heat and power systems; methodology of scientific research of heat and power and heat engineering facilities</p> <p>Acquisition of universal knowledge based on fundamental theories, concepts, ideas, principles, combined into a single worldview system as a factor of further professional growth and the ability to solve a wide range of general tasks in the field of energy management of thermal power systems and reduce negative environmental impact;</p>

	<p>formation of spirituality, spiritual culture of the individual, in particular through the development of his or her spiritual needs, creation of psychological and pedagogical conditions for spiritual development as the basis for personal formation of a specialist and development of the country's human potential;</p> <p>Ensuring the possibility of creative self-realization of the individual by creating an educational environment that promotes self-knowledge, self-esteem, and self-development, based on academic freedom, mobility, integrity and student-centered learning;</p> <p>Acquisition of social skills of business communication and management as an element of professional activity.</p> <p><i>Theoretical content of the subject area:</i> theoretical foundations of production, conversion, application of thermal energy production, transformation, application; thermal power plants; heat and power installations; principles of heat and mass transfer, thermodynamics and related issues of strength, fluid dynamics, mechanics of structural materials.</p> <p><i>Methods, techniques and technologies of energy generation, transmission and use; operation, control and monitoring of energy equipment; methods of physical, computer and mathematical modeling; data processing methods.</i></p> <p><i>Tools and equipment:</i> main and auxiliary equipment of heat and power engineering, means of automation and control of heat and power processes; technological, instrumental, metrological, diagnostic, information facilities and equipment.</p>
Academic and professional rights of graduates	Possibility of studying under the program of the third (educational and scientific) level of higher education. Acquisition of additional qualifications in the system of postgraduate education
Quantity. semesters/years of study	3 / 1 year, 4 months.

2.2. Requirements for the level of education of persons who can start studying under the educational and professional program: a bachelor's or master's degree (specialist's degree).

2.3. The number of ECTS credits required to complete the educational and professional program is 90 ECTS credits.

The internship must be at least 10 ECTS credits.

At least 35 percent of the educational program should be directed to the acquisition of general and special (professional) competencies in the educational and professional program, defined by the draft Standard of Higher Education for Master's Degree in Heat and Power Engineering, specialty 144 Heat and Power Engineering, field of knowledge 14 Electrical Engineering.

The volume of disciplines of students' free choice must be at least 25 percent of the total number of ECTS credits provided by the educational program.

2.4. Expected programmatic learning outcomes (competencies) that a higher education student must master

Integral competence	EC-1. Ability to solve complex tasks and problems in the energy sector in the field of energy management and/or in the learning process, which involves research and/or innovation and is characterized by uncertainty of conditions and requirements	
General competencies	ZK 01	Knowledge and understanding of the subject area and understanding of professional activities
	ZK 02	Ability to think abstractly, analyze and synthesize
	ZK 03	Ability to identify, formulate and solve problems
	ZK 04	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge/ types of economic activity)
	ZK 05	Ability to act in a socially responsible and conscious manner
Special (professional, subject) competencies	FC 01	Ability to apply and improve mathematical and computer models, scientific and technical methods and modern computer software for solving complex engineering problems in the thermal power industry
	FC 02	Ability to analyze and integrate comprehensively

		modern knowledge of natural, engineering, socio-economic and other sciences to solve complex problems and challenges in the heat and power industry
	FC 03	Ability to apply relevant mathematical methods to solve complex problems in the field of heat and power engineering
	FC 04	Ability to manage work processes and make effective decisions in the field of heat and power engineering, taking into account social, economic, commercial, legal, and environmental aspects
	FC 05	Ability to develop, implement, implement and support projects taking into account all aspects of the problem to be solved, including the stages of design, production, operation, maintenance and utilization of heat and power equipment
	FC 06	Ability to make decisions on materials, equipment, processes in the heat and power industry with Taking into account their properties and characteristics
	FC 07	Ability to carry out innovative activities in the heat and power industry

PLO 01. Analyze, apply and create complex engineering technologies, processes, systems and equipment in accordance with the chosen field of heat power engineering.

ELO 02. Analyze and select effective analytical, computational and experimental methods for solving complex problems of heat and power engineering.

PLO 03. Develop and implement projects in the field of heat and power engineering, taking into account the goals, forecasts, constraints and risks, and taking into account technological, legislative, social, economic, environmental and other aspects.

LO 04. Find necessary information from various sources, evaluate, process and analyze this information.

WP 05. Develop and investigate physical, mathematical and computer models of heat and power facilities and processes, check the adequacy of models, compare modeling results with other data and evaluate their accuracy and reliability.

LO 06. Make effective decisions using modern methods and tools for comparing alternatives, risk assessment and forecasting.

LO 07. To know, understand and apply in practice key concepts, modern knowledge and best practices in the heat and power industry, technologies of energy production, transmission, distribution and use.

ELO 08. Justify the selection and use of materials, equipment and tools, engineering technologies and processes, taking into account their characteristics and properties, requirements for the final product, as well as non-technical aspects.

ELO 09. Communicate fluently in the state language on professional issues, discuss the results of production, research and innovation activities with specialists and non-specialists.

PO 10. Understand the strategy and goals of the enterprise (institution), taking into account the positive contribution to the development of society and the state, the creation and implementation of innovative technologies, and personnel development.

OBJECTIVE 11. Evaluate and ensure the quality of heat and power facilities and processes.

ELO 12. Communicate clearly and unambiguously own conclusions on heat and power problems, as well as the knowledge and explanations that justify them, to specialists and non-specialists.

PO 13. To know the main provisions of national and international legislation and practices of international activity in the field of heat and power engineering.

ELO 14. Plan and implement measures to improve the energy efficiency of heat and power facilities and systems, taking into account existing constraints, including those related to environmental protection, sustainable development, health and safety, and risk assessments in the heat and power sector, and evaluate the effectiveness of such measures.

ELO 15. Understanding of professional and ethical standards of activity, their application in the field of heat and power engineering.

ELO 16. Analyze and evaluate the problems of heat and power engineering related to the development of new technologies, science, society and economy.

EO 17. Effectively cooperate with colleagues, taking responsibility for a particular area and contributing to the overall performance, as well as personal development and the development of the team.

The correspondence between learning outcomes and competencies is shown in Table 1, and the correspondence between learning outcomes and educational components is shown in Table 2.

3. List of educational components and their logical sequence

N o. s/n	Educational component	Number of ECTS credits	Duration of study (in semesters)	Form of final control
1. GENERAL TRAINING CYCLE				
OK 01	Methods of scientific research	5	1	offset
OK 02	Energy audit of railway transport enterprises	3	1	examination

OK 03	Energy management	3	1	examination
OK 04	Organization and management of environmental protection activities at enterprises transportation	8	1	examination
	Scope of normative educational components	19	-	-
Disciplines of free choice of the student of the general training cycle				
VK 01	Discipline 1**.	3	1	*
VK 01	Discipline 2**.	3	1	*
	Scope of elective educational components	6	-	-
	Total volume of educational components of the cycle	25	-	-
2. PROFESSIONAL TRAINING CYCLE				
OK 05	Resource efficient and clean production	3	1	examination
OK 06	Production organization and logistics basics	3	1	offset
OK 7	Energy-saving technologies and materials; quality, standardization and certification in heat and power engineering	3	1	offset
OK 8	Renewable and unconventional energy resources	5	1	offset
OK 9	Organization of operation of heat and power supply systems supply of industrial enterprises	4,5	1	offset
	Scope of normative educational components	18,5	-	-
Disciplines of free choice of the student of the professional training cycle				
VK 03	Discipline 2**.	6	1	*
VK 04	Discipline 3**.	6	1	*
VK 05	Discipline 4**.	6	1	*
	Scope of elective educational components	18	-	-

	Total volume of educational components of the cycle	36,5	-	-
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OK 10	Pre-graduation practice	6	-	offset
OK 11	Preparation qualification work	21	-	
OK 12	Defense of qualification work	1,5		examination
	Total volume educational and professional program	90	-	-

* - the form of final control is determined by the curriculum;

** - the educational component is determined by the results of students' choice in accordance with the established procedure.

The logical sequence of studying the educational components is determined by their order of priority (for educational components that are studied over several semesters, the beginning of the study of educational components is determined by the first semester of their study). The educational components of the next stage cannot be studied before or simultaneously with the start of the study of the educational components of the previous stage.

The order of studying educational components:

1) educational components of the first stage:

energy audit;

renewable and unconventional energy resources.

2) educational components of the second stage:

energy management;

energy saving in electrical systems.

3) educational components of the third stage:

research practice

4) educational component of the fourth stage:

A comprehensive state exam.

5) The order of study of other educational components is determined by the curriculum.

4. Forms of certification of higher education applicants

Forms of certification of higher education applicants	Certification is carried out in the form of a single state qualification exam (qualification exam)
Requirements for the Unified State Qualification Exam	The Unified State Qualification Exam (qualification exam) should test the achievement of learning outcomes

5. Requirements for an internal quality assurance system for higher education

The Ukrainian State University of Railway Transport has a system for ensuring the quality of educational activities and the quality of higher education (internal quality assurance system), which provides for the following procedures and measures:

- 1) defining the principles and procedures for ensuring the quality of higher education;
- 2) monitoring and periodic review of educational programs;
- 3) annual evaluation of higher education students, research and teaching staff of the higher education institution and regular publication of the results of such evaluations on the official website of the higher education institution, on information stands and in any other way;
- 4) Providing professional development for pedagogical, scientific and research staff;
- 5) ensuring the availability of the necessary resources for the organization of the educational process, including independent work of students, according to the educational program;
- 6) ensuring the availability of information systems for effective management of the educational process;
- 7) ensuring publicity of information about the educational program, degree of higher education and qualifications;
- 8) ensuring an effective system for preventing and detecting academic plagiarism in the scientific works of employees and students.

Table 1 - Matrix of correspondence between learning outcomes and competencies

Program learning outcomes	Competencies													
	Integral competence	General competencies					Special (professional) competencies							
		ZK01	ZK02	ZK03	ZK04	ZK05	FC01	FC02	FC03	FC04	FC05	FC06	FC07	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
RN 01	Ability to solve complex tasks and problems in the energy industry in the field of energy management and/or in the process of training, which involves research and/or innovation and is characterized by uncertainty of conditions and requirements	+	+	+			+	+				+	+	
PH 02		+	+	+			+	+	+					
PH 03		+	+	+	+				+			+		
RN 04		+	+	+					+	+		+		+
PH 05		+	+					+	+	+				
PH 06		+	+	+	+	+	+	+		+	+	+		+
RN 07		+	+						+			+	+	+
PH 08		+	+						+			+	+	+
RN 09		+	+	+	+				+					+
PH 10		+	+	+		+					+			+
RN 11		+	+			+					+	+	+	
PH 12		+	+	+	+						+			+
RN 13		+	+	+		+					+	+		+
RN 14		+	+	+				+	+	+	+	+	+	+
PH 15		+	+	+	+	+	+				+	+		+
RN 16		+	+	+		+			+	+	+	+	+	+
RN 17		+	+	+	+	+	+				+	+		

Table 2 - Matrix of correspondence between learning outcomes and educational components

Program learning outcomes	OK01	OK02	OK03	OK04	OK05	OK06	OK07	OK08	OK10	OK10	OK11	OK12
RN 01					+	+		+	+		+	+
PH 02			+	+	+			+			+	+
PH 03			+	+	+	+		+			+	+
RN 04	+	+	+		+		+	+		+	+	+
PH 05							+	+			+	+
PH 06				+	+	+			+	+	+	+
RN 07				+			+	+	+		+	+
PH 08					+		+	+			+	+
RN 09		+									+	+
PH 10		+		+	+		+				+	+
RN 11				+		+		+		+	+	+
PH 12					+			+		+	+	+
RN 13				+	+		+			+	+	+
RN 14	+		+	+	+			+	+		+	+
PH 15	+		+					+		+	+	+
RN 16	+							+	+		+	+
RN 17		+		+	+		+	+			+	+

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A.S. Kharchenko