

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE  
«IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE»**

**HEAT POWER ENGINEERING AND HEAT POWER  
INSTALLATIONS OF POWER PLANTS**

**EDUCATIONAL AND SCIENTIFIC PROGRAM  
of second (master's) higher education level**

**in the specialty  
in the field of knowledge  
qualification**

**144 Heat Power Engineering  
14 Electrical Engineering  
Master of Heat Power  
Engineering**

## PREAMBLE

### **DEVELOPED by the project team:**

#### *Project team leader:*

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The Department of Heat Power Engineering and Heat Power Installations of Power Plants is responsible for the preparation of applicants for higher education, according to the educational and scientific program.

## TABLE OF CONTENTS

1. PROFILE OF THE EDUCATIONAL PROGRAM.....	4
2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM .....	8
3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM.....	10
4. FORM OF GRADUATE CERTIFICATION OF HIGHER EDUCATION APPLICANTS .....	11
5. THE MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCIES WITH THE COMPONENTS OF THE EDUCATIONAL PROGRAM .....	12
6. THE MATRIX OF PROVIDING PROGRAM LEARNING OUTCOMES WITH THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM.....	13

# 1. PROFILE OF THE EDUCATIONAL PROGRAM

## in the specialty 144 Heat Power Engineering

<b>1 – General information</b>	
Complete name of IHE and institute / faculty	National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Faculty of Heat and Power Engineering
Degree of higher education and title of qualification in the original language	Degree of higher education – master Educational qualification – Master of Heat Power Engineering
The official name of the EP	Heat Power Engineering and Heat Power Installations of Power Plants
Type of diploma and scope of educational program	Master's diploma, single, 120 ECTS credits, term of study 1 year 9 months
Availability of accreditation	A new program has been developed, accreditation is envisaged.
Cycle / level of HE	NQF of Ukraine – level 8. QF-EHEA – the second cycle. EQF-LLL – level 7.
Prerequisites	Having a bachelor's degree
Languages of education	Ukrainian / English
The validity of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	<a href="https://tes.kpi.ua/">https://tes.kpi.ua/</a> <a href="https://tpt.tef.kpi.ua/">https://tpt.tef.kpi.ua/</a> <a href="https://osvita.kpi.ua/">https://osvita.kpi.ua/</a>
<b>2 – The purpose of the educational program</b>	
Training of a specialist capable of solving complex problems and problems in the heat and power industry and carrying out innovative professional activities	
<b>3 – Characteristics of the educational program</b>	
Subject area	Field of knowledge – 14 Electrical Engineering Specialty – 144 Heat Power Engineering <i>Objects of study and activity:</i> heat power equipment of thermal and nuclear power plants, industry, utilities; heat and cold supply systems; non-traditional (alternative) energy technologies; energy metering, regulation and automation systems; means of designing thermal power plants and systems; energy management and audit. <i>Learning objectives:</i> training of specialists capable of independently designing and analyzing modern thermal power systems; determine the optimal parameters of heat power devices; conduct energy efficiency analysis and propose energy saving measures that will help reduce fuel and energy usage and negative impact on the environment. <i>Theoretical content of the subject area:</i> theoretical foundations of production, transformation, application of heat energy; thermal power plants; cogeneration installations; principles of heat and mass transfer, thermodynamics and issues of strength, hydro and gas dynamics, mechanics of structural materials related to heat energy.

	<p><i>Methods, techniques and technologies</i> for obtaining, transmitting, and using energy; exploitation, control and monitoring of power equipment; methods of physical, computer and mathematical modeling; data processing methods.</p> <p><i>Tools and equipment:</i> main and auxiliary equipment of heat energy, means of automation and control of heat energy processes; technological, instrumental, metrological, diagnostic, information means and equipment.</p>
Orientation of the educational program	Educational and scientific
The main focus of the educational program	Special education in the field of knowledge Electrical engineering in the specialty Heat Power Engineering of relevant specializations heat power engineering, thermophysics, energy saving, heat exchange processes, heat technological equipment.
Features of the program	The possibility of the existence of the semester of international mobility. The availability of special practice.
<b>4 – Suitability of graduates for employment and further study</b>	
Suitability for employment	The specialist is prepared to work in the heat and power industry according to the National Classifier of Ukraine: Classifier of professions DK 003: 2010. Specialist by qualification level of works: 2143.2 Energy Engineer, 2149.2 Research Engineer.
Suitability for further study	Continuation of education at the third (educational and scientific) level of higher education and / or acquisition of additional qualifications in the system of adult education.
<b>5 – Teaching and assessment</b>	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; calculation works, calculation-graphic works, home tests, essays, technology of blended learning, practice and excursions; implementation of a master's dissertation.
Assessment	The rating system of assessment, oral and written exams.
<b>6 – Program competencies</b>	
Integral competence	Ability to solve complex tasks and problems in the heat industry or in the learning process, which involves research and / or implementation of innovations and is characterized by uncertainty of conditions and requirements.
<b>General competences (GC)</b>	
GC 1	Knowledge and understanding of the subject area and understanding of professional activity.
GC 2	Ability to abstract thinking, analysis and synthesis.
GC 3	Ability to identify, pose and solve problems.
GC 4	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity).
GC 5	The ability to act socially responsibly and consciously.
<b>Professional competencies (PC)</b>	
PC 1	Ability to apply and improve mathematical and computer models, scientific and technical methods and modern computer software to solve complex engineering problems in thermal power.
PC 2	Ability to analyze and comprehensively integrate modern knowledge of natural, engineering, socio-economic and other sciences to solve complex tasks and problems of thermal energy.
PC 3	Ability to apply relevant mathematical methods to solve complex problems in heat energy industry.

PC 4	Ability to manage work processes and make effective decisions in the field of heat engineering, taking into account social, economic, commercial, legal, and environmental aspects.
PC 5	Ability to develop, 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 thermal power equipment.
PC 6	Ability to make decisions about materials, equipment, processes in the heat engineering, taking into account their properties and characteristics.
PC 7	Ability to carry out innovative activities in the heat engineering industry.
PC 8	Ability to carry out scientific and applied researches in the heat engineering industry .
PC 9	Ability to carry out scientific and pedagogical activities in higher education institutions.
<b>7 – Program learning outcomes</b>	
PLO 1	Analyze, apply and create complex engineering technologies, processes, systems and equipment in accordance with the chosen direction of heat energy industry.
PLO 2	Analyze and select effective analytical, computational and experimental methods for solving complex problems of heat power engineering.
PLO 3	Develop and implement projects in the field of thermal energy taking into account the goals, forecasts, constraints and risks and taking into account technological, legislative, social, economic, environmental and other aspects.
PLO 4	Search for the necessary information from various sources, evaluate, process and analyze this information.
PLO 5	Develop and research physical, mathematical and computer models of thermal power facilities and processes, check the adequacy of models, compare simulation results with other data and evaluate their accuracy and reliability.
PLO 6	Make effective decisions using modern methods and tools for comparing alternatives, risk assessment and forecasting.
PLO 7	Know, understand and apply in practice key concepts, modern knowledge and best practices in the heat energy industry, technology of production, transmission, distribution and usage of energy.
PLO 8	Justify the choice and application 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.
PLO 9	Communicate freely in the state language on professional issues, discuss the results of production, research and innovation with professionals and non-specialists.
PLO 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, staff development.
PLO 11	Evaluate and ensure the quality of heat power facilities and processes.
PLO 12	Communicate clearly and unambiguously to specialists and non-specialists one's own conclusions on the problems of heat energy, as well as the knowledge and explanations that substantiate them.
PLO 13	Know the basic provisions of domestic and international legislation and practices of international activities in the field of heat power engineering.
PLO 14	Plan and implement measures to improve the energy efficiency of heat power facilities and systems, taking into account existing constraints, including those related to nature protection, sustainable development, health and safety and risk assessments in the heat power sector. Evaluate the effectiveness of such measures.
PLO 15	Understanding of professional and ethical standards of activity, their application during activity in the field of heat power engineering.
PLO 16	Analyze and evaluate the problems of heat energy related to the development of new technologies, science, society and economy.

PLO 17	Effectively cooperate with colleagues, taking responsibility for a particular direction and their contribution to the common results of activities, as well as their own development and team development.
PLO 18	Perform research, analyze, process, evaluate and present research results, argue conclusions.
PLO 19	Participate in the teaching of disciplines related to heat power engineering in higher education institutions.
<b>8 – Resource support for program implementation</b>	
Staffing	In accordance with the personnel requirements to ensure the implementation of educational activities for the relevant level of higher education (Annex 12 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended on 23.05.2018 № 347.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the appropriate level of higher education (Annex 13 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187.
Informational, educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the appropriate level of higher education (Annexes 14 and 15 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187.
<b>9 – Academic mobility</b>	
National credit mobility	Possibility of concluding agreements on academic mobility and double diplomacy.
International credit mobility	Agreement 13-UA on a double degree program with the University of La Laguna (Kingdom of Spain). Agreement NUA-CH-4 on the double degree program with the Institute of Energy of the Academy of Sciences of Shandong Province (Jinan, China). Agreement on the Double Diploma Program with the L.N. Gumilyov Eurasian National University (Astana, Kazakhstan). Agreement on the Double Diploma Program with Opole Polytechnic (Opole, Poland). Agreement on International Academic Mobility (Erasmus + K1) with the Middle East Technical University (Ankara, Turkey). Agreement on International Academic Mobility (Erasmus + K1) with the Polytechnic University (Valencia, Kingdom of Spain).
Training of foreign applicants for higher education	Teaching an applicants in a foreign language.

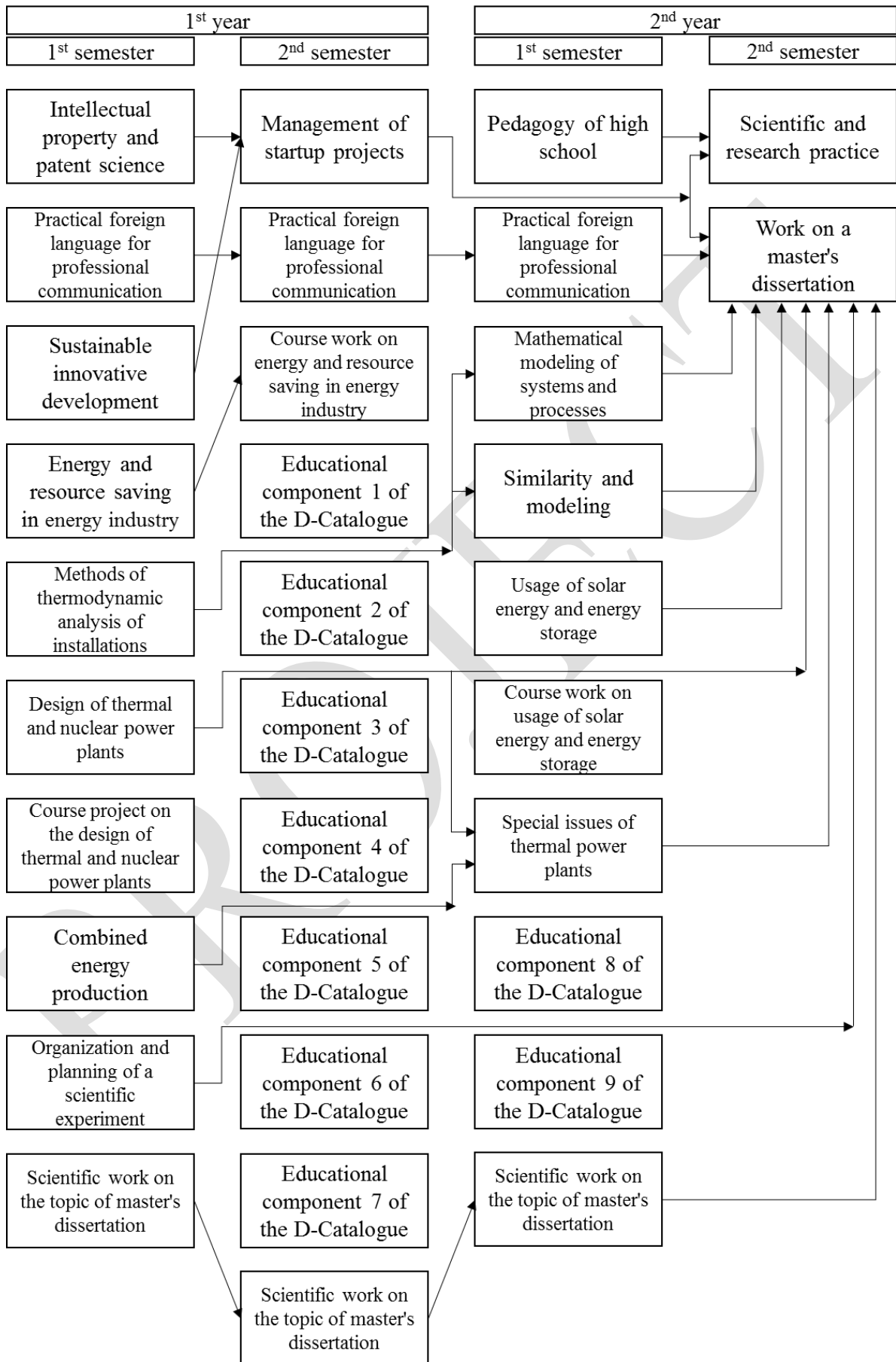
## 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Course code	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	ECTS credits	Form of final control
1	2	3	4
<b>1. General training cycle</b>			
<b>Mandatory components of the educational program</b>			
GM 1	Intellectual property and patent science	3,0	test
GM 2	Sustainable innovative development	2,0	test
GM 3	Management of startup projects	3,0	test
GM 4	Practical foreign language for professional communication	4,5	test
GM 5	Pedagogy of high school	2	test
<b>2. Professional training cycle</b>			
<b>Mandatory components of the educational program</b>			
PM 1	Energy and resource saving in energy industry	4,0	exam
PM 2	Course work on energy and resource saving in energy industry	1,0	test
PM 3	Methods of thermodynamic analysis of installations and systems	6,0	exam
PM 4	Design of thermal and nuclear power plants	4,5	exam
PM 5	Course project on the design of thermal and nuclear power plants	1,5	test
PM 6	Combined energy production	2,5	test
PM 7	Organization and planning of a scientific experiment	3,0	test
PM 8	Mathematical modeling of systems and processes	4,0	exam
PM 9	Similarity and modeling	4,0	exam
PM 10	Usage of solar energy and energy storage	2,5	test
PM 11	Course work on usage of solar energy and energy storage	1,0	test
PM 12	Special issues of thermal power plants	4,0	exam
PM 13	Scientific work on the topic of master's dissertation	7,5	test
PM 14	Scientific and research practice	9,0	test
PM 15	Work on a master's dissertation	21,0	defense
<b>Optional components of the educational program</b>			
ΠB 1	Educational component 1 of the D-Catalogue	6,0	exam
ΠB 2	Educational component 2 of the D-Catalogue	3,0	test
ΠB 3	Educational component 3 of the D-Catalogue	2,5	test
ΠB 4	Educational component 4 of the D-Catalogue	2,5	exam
ΠB 5	Educational component 5 of the D-Catalogue	2,0	test
ΠB 6	Educational component 6 of the D-Catalogue	4,5	exam



1	2	3	4
ΠΒ 7	Educational component 7 of the D-Catalogue	2,0	test
ΠΒ 8	Educational component 8 of the D-Catalogue	4,5	test
ΠΒ 9	Educational component 9 of the D-Catalogue	3,0	test
<b>Total volume of mandatory educational components of the general training cycle:</b>		<b>14,5</b>	
<b>Total volume of mandatory educational components of the professional training cycle:</b>		<b>75,5</b>	
<b>Total volume of the optional educational components:</b>		<b>30</b>	
<b>TOTAL VOLUME OF THE EDUCATIONAL PROGRAM</b>		<b>120</b>	

### 3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



#### **4. FORM OF GRADUATE CERTIFICATION OF HIGHER EDUCATION APPLICANTS**

Graduation certification of applicants for higher education under the educational-scientific program "Heat Power Engineering and Heat Power Installations of Power Plants" in specialty 144 Heat Power Engineering is carried out in the form of defense of master's dissertation and ends with the issuance of a standard document on the award of a master's degree with the qualification of a master's degree in heat power engineering.

The master's dissertation is checked for the absence of academic plagiarism, fabrication and falsification. The master's dissertation is placed in the repository of the Denisenko Scientific and Technical Library for free access after the defense. Graduation certification is open and public.

**5. THE MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCIES WITH THE COMPONENTS OF THE EDUCATIONAL PROGRAM**

	GM 1	GM 2	GM 3	GM 4	GM 5	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15
GC1	+					+		+	+		+		+	+			+	+	+	+
GC2		+	+					+				+	+				+	+	+	+
GC3	+	+				+	+					+			+	+		+		+
GC4	+		+	+	+				+	+					+	+			+	
GC5		+	+		+				+	+					+	+		+	+	+
PC 1											+		+	+				+		+
PC 2			+			+		+	+		+	+	+	+	+		+	+		+
PC 3								+					+	+	+	+		+		+
PC 4		+				+	+		+	+	+				+	+	+			+
PC 5		+							+	+						+		+	+	+
PC 6			+			+	+		+	+		+			+	+		+	+	+
PC 7	+	+						+									+			+
PC 8						+	+	+				+	+	+			+		+	+
PC 9				+	+			+	+			+	+				+		+	

**6. THE MATRIX OF PROVIDING PROGRAM LEARNING OUTCOMES WITH THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM**

	GM 1	GM 2	GM 3	GM 4	GM 5	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15
PLO 1						+	+	+	+		+	+			+	+			+	+
PLO 2								+				+	+	+				+		+
PLO 3	+		+			+	+		+	+	+				+	+	+		+	+
PLO 4	+	+			+				+	+		+		+			+	+	+	+
PLO 5								+				+	+	+				+		+
PLO 6		+	+				+		+	+		+		+		+	+			
PLO 7						+	+		+		+		+		+		+			+
PLO 8						+	+		+	+	+			+	+	+			+	+
PLO 9				+	+					+			+					+	+	
PLO 10		+	+					+	+	+					+				+	
PLO 11								+		+	+						+			
PLO 12				+		+	+					+						+	+	+
PLO 13	+					+	+		+	+								+	+	
PLO 14						+	+				+					+	+			+
PLO 15			+						+										+	
PLO 16	+	+					+				+						+			+
PLO 17		+	+						+	+								+	+	+
PLO 18				+		+		+				+	+	+		+		+	+	+
PLO 19				+	+										+			+	+	