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

APPROVED
Academic Council of Igor Sikorsky KPI.
(Protocol № ___ dated _____20__)
Chairman of the Academic Council
_____ Mykhailo ILCHENKO

Heat and power engineering
EDUCATIONAL AND SCIENTIFIC PROGRAM

third (educational and scientific) level of higher education

specialty	**144 Heat and Power engineering**
field of knowledge	**14 Electrical Engineering**
qualification	**philosophy doctor of heat power engineering**

Put into effect by the Rector's Order
Igor Sikorsky KPI
From _____ № _____

Kyiv - 2020

PREAMBLE

DEVELOPED by the project team:

Project team leader:

Chernousenko Olga Yuriyivna - Head of the Department of Thermal Power Facilities, Heat and Nuclear Power Plants, Faculty of Heat and Power Engineering, Doctor of Technical Sciences, Professor

Project team members:

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– *Shklyar Viktor Ivanovych - Associate Professor of the Department of Heat Engineering and Energy Saving, Institute of Energy Saving and Energy Management, Ph.D., Associate Professor*
– *Head of the Nuclear Power Plants and Engineering Thermal Physics Department, Faculty of Heat and Power Engineering, Tuz Valeriy Omelyanovich Doctor of Technical Sciences, Professor*
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– *Head of the Department of Heat Engineering and Energy Saving, Institute of Energy Saving and Energy Management Deshko Valeriy Ivanovych, Doctor of Technical Sciences, Professor*

AGREED:

Scientific and methodical commission of Igor Sikorsky KPI, specialty 144 "Heat Power Engineering"
Chairman of the SMC _____ Olga CHERNOUSENKO
(Protocol № ___ of ___ _____ 2020)
Methodical council of Igor Sikorsky KPI
Chairman of the Methodical Council _____ Yuriy YAKYMENKO
(Protocol № ___ of ___ _____ 2020)

TAKEN INTO ACCOUNT:

1. Methodical recommendations of the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine (Protocol of February 6, 2020 №7 https://mon.gov.ua/ua/osvita/visha-osvita/naukovo-metodichna-rada-ministerstva-osviti-i-nauki-ukrayini/metodichni-rekomendaciyi-vo)
2. Comments and suggestions of stakeholders based on the results of the public discussion:
    - scientific and teaching staff of the Department of Thermal Power Facilities, Heat and Nuclear Power Plants of Faculty of Heat and Power Engineering, Nuclear Power Plants and Engineering Thermophysics Department of Faculty of Heat and Power Engineering, Department of Theoretical and Industrial Heat Engineering of Faculty of Heat and Power Engineering, Department of Heat Engineering and Energy Saving of Institute of Energy Saving and Energy Management;
    - applicants for higher education who study at educational programs of the specialty 144 Heat Power Engineering;
    - specialists of the educational and methodical department of Igor Sikorsky KPI;
    - specialists in the field of heat power engineering (reviews and letters of support are attached).

The ESP was discussed after receiving all wishes and suggestions from students, graduates and employers and approved at session of the scientific-methodical commission of Igor Sikorsky KPI, specialty 144 "Heat Power Engineering" (protocol №4 from August 31, 2020).

1. PROFILE OF THE EDUCATIONAL PROGRAM

1 - General information	
Full name of higher education institution and institute / faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Heat and Power Engineering
Higher education degree and title of qualification in the original language	Degree of higher education - Philosophy Doctor Educational qualification - Philosophy Doctor in Heat Power Engineering
The official name of the educational program	Educational program Heat power engineering of the third (educational-scientific) level of higher education
Type of diploma and scope of educational program	Philosophy Doctor diploma, Educational component 50 credits ECTS, training period 4 years The scientific component involves conducting of scientific research and presentation of its results in the form of a dissertation.
Accreditation	Accreditation is expected in 2021.
Cycle/level of higher education	NRC of Ukraine - level 9 QF-EHEA - the third cycle EQF-LLL - level 8
Prerequisites	Master's degree
Language (s) of teaching	Ukrainian/English
Term of the educational program	Until the next accreditation
Internet address of the educational program	https://kpi.ua/tef http://tes.kpi.ua/?page_id=2245 http://tpt.tef.kpi.ua/ http://aesiitf.kpi.ua/?page_id=5394 http://te.kpi.ua/ *https://osvita.kpi.ua/ section Educational programs*
2 - The purpose of the educational program	
Training of highly qualified, competitive, integrated into the European and world scientific and technical space specialists of the degree of Philosophy Doctor in Heat Power Engineering, capable of self-dependent research, scientific-innovation, organizational and managerial, teaching activities in the field of 144 "Heat Power Engineering" and related fields at higher education institutions, through the internationalization of the educational process in terms of sustainable innovative scientific and technological development and is implemented through: - harmonious and multidimensional education of future highly qualified technical specialists, able to comprehensiv and systematic analysis of problems in heat power engineering and related fields, realizing the nature of surrounding processes and phenomena, to provide and conduct intercultural communication; - formation of high adaptability of higher education seekers in the conditions of labor market transformation through interaction with employers and other stakeholders. The purpose of the educational program corresponds to the development strategy of Igor Sikorsky KPI for 2020-2025 on the formation of the society of the future on the basis of the concept of sustainable development.	
3 - Characteristics of the educational program	
Subject area	*Object of activity*: processes of production, conversion, transfer and

	using of thermal energy of fuels, renewable sources and heat carriers in power facilities; development of methods of calculation, intensification of heat and mass transfer; scientific, technical and technological problems of creation and operation of heat and nuclear power facilities, auxiliary power systems and equipment. *Theoretical content of the subject area:* fundamental and applied research, analysis, design, innovative approaches to solving complex problems in the field of electrical engineering; scientific concepts of energy transformation, principles of heat and mass transfer, thermodynamics and connected principles of strength, hydro-gas dynamics, mechanics of structural materials. *Methods, techniques and technologies*: general scientific methods of cognition and research, methods of obtaining, transmitting, efficient and ecological using of energy, design, operation, control, monitoring, and energy audit, energy management, organization of scientific and production processes with quality control; methods of physical and mathematical modeling and data processing. *Tools and equipment*: means of technological, instrumental, metrological, diagnostic and organizational providing of production processes, information and communication equipment, means of automation and control of heat power engineering.
Orientation of the educational program	Educational - scientific
The main focus of the educational program	Special education in the field of knowledge 14 Electrical engineering in the specialty 144 Heat power engineering Acquisition of educational qualification for scientific-innovative and scientific-pedagogical professional activity in the field of electrical engineering and power energetics. The program is aimed at forming such competencies of higher education students that enable their comprehensive professional, intellectual, social and creative development, taking into account new realities and current challenges for engineering, research and innovation (including international) activities. Applicants for higher education have the opportunity to acquire knowledge in related fields, to obtain skills of using modern computer tools for design and modeling of processes and other educational components through the possibility of forming a flexible individual learning trajectory. Keywords: heat power engineering, heat power facilities, thermal physics, energy saving, heat exchange processes, heat technological equipment
Features of the program	The implementation of the program includes the involvement of practitioners, industry experts, representatives of employers to classes. Some special courses are teached in English
4 - Suitability of graduates for employment and further study	
Suitability for employment	The specialist is prepared to work in the heat power engineering industry according to the National Classifier of Ukraine: Classifier of professions ДК 003: 2010. Specialist by qualification level of works: 2149.1 Researcher (engineering field), 2310.2 Teacher of higher education institution

Further training	Continuing education in doctoral studies and/or participation in postdoctoral programs
5 - Teaching and assessment	
Teaching and learning	Student-centered learning, self-study, problem-oriented learning, learning through laboratory practice. All participants in the educational process are provided with timely and understandable information on the goals, content and program learning outcomes, the assessment procedure and criteria within the individual educational components. General learning style - task-oriented. Teaching is carried out in the form of: lectures, seminars, practical classes, laboratory classes in small groups (up to 8 people), independent work with the possibility of consultation with the teacher, individual lessons, application of information and communication technologies for individual educational components, mixed learning technology, practice and excursions; conducting research; performing a doctoral dissertation; holding regular conferences, seminars, colloquia, access to the use of laboratories, equipment, etc.
Assessment	Current and semester control in the form of reports, presentations, essays, written and oral examinations and defense of qualification work are evaluated in accordance with the defined criteria of the Rating system.
6 - Program competencies	
Integral competence	Ability to solve complex problems in the field of professional and/or research and innovation activities in the field of heat power engineering, which involves a deep rethinking of existing and the creation of new holistic knowledge and/or professional practice.
General Competences (GC)	
ЗК1	Ability to abstract thinking, analysis and synthesis.
ЗК2	Ability to work in an international context
ЗК3	Ability to develop and manage projects.
Professional competencies of the specialty (PC)	
ФК1	Ability to perform an original research, achieve scientific results that create new knowledge in the field of heat power engineering and related interdisciplinary areas and can be published in leading scientific journals in heat power engineering and related fields.
ФК2	Ability to orally and writting presentation and discussing of the results of research and/or innovative developments in Ukrainian and English, a deep understanding of English-language scientific texts in the field of heat power engineering research.
ФК3	Ability to carry out scientific and teaching activities in higher education at heat power engineering.
ФК4	Ability to identify, formulate and solve research problems in the field of heat power engineering, evaluate and ensure the quality of research.
ФК5	Ability to initiate, develop and implement complex innovative projects in the heat power engineering industry and related interdisciplinary projects, leadership in their implementation.
ФК6	Ability to understand modern problems of scientific and technical development of power energetics, to know modern technologies of energy and resource saving.

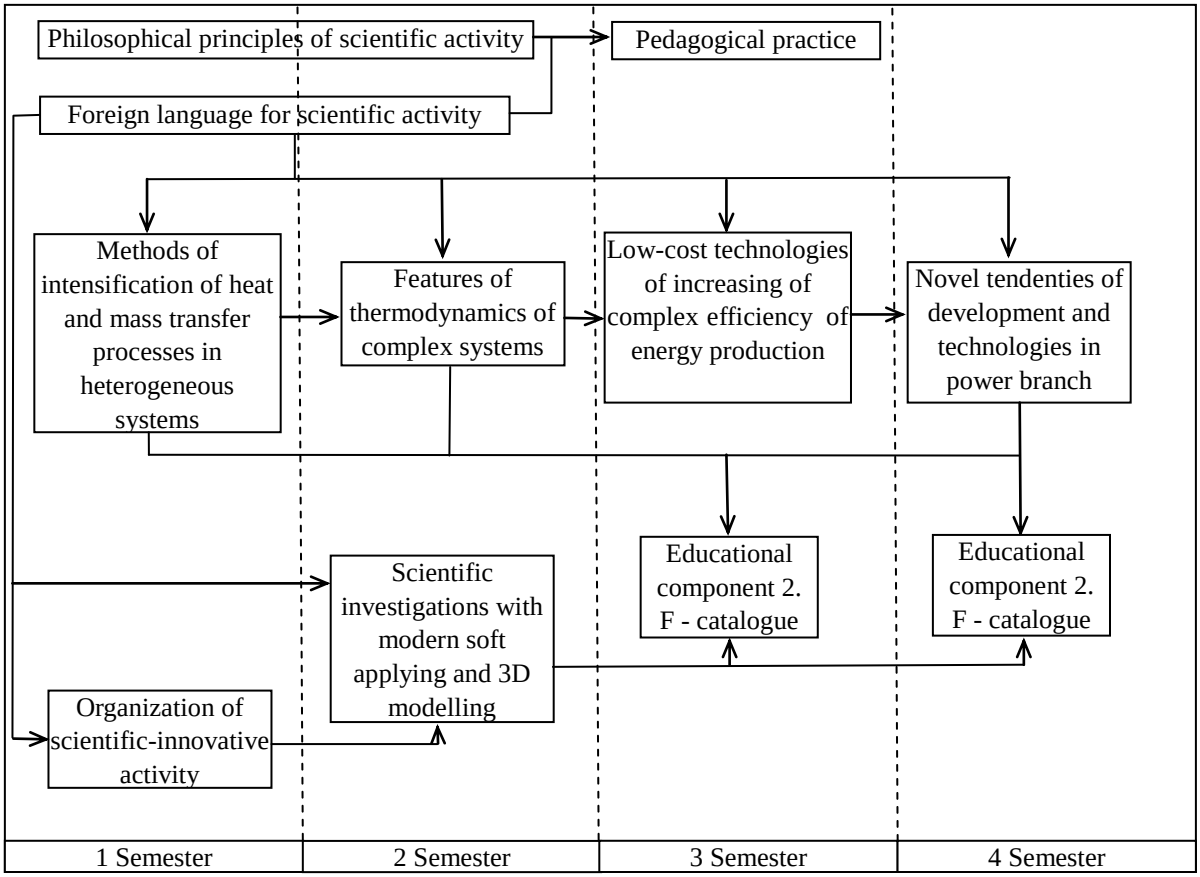
7 - Program learning outcomes	
ПРН1	To have advanced conceptual and methodological knowledge in heat power engineering and cross-border fields, as well as research skills sufficient to conduct scientific and applied research at the level of the latest world achievements in heat power engineering and to gain new knowledge and/or to innovate.
ПРН2	To present and discuss with specialists and non-specialists the results of research, scientific and applied problems of heat power engineering in the state and foreign languages freely, to qualified reflect the results of research in scientific publications in leading international scientific journals.
ПРН3	To formulate and to check hypotheses; to use appropriate evidence to substantiate the conclusions, in particular, the results of theoretical analysis, experimental research (surveys, observations, etc.) and mathematical and/or computer modeling, available literature data.
ПРН4	To develop and to research conceptual, mathematical and computer models of processes and systems, to use them effectively to gain new knowledge and/or to create innovative products in heat power engineering and related interdisciplinary areas.
ПРН5	To plan and to perform experimental and/or theoretical research in heat power engineering and related interdisciplinary areas with using of modern tools, to analyze critically the results of own research and the results of other researchers in the context of the whole set of modern knowledge on the research problem.
ПРН6	To develop and to implement scientific and/or innovative engineering projects that provide an opportunity to rethink existing and to create new holistic knowledge and/or professional practice and to solve significant scientific and technological problems of heat power engineering in compliance with academic ethics, social, economic, environmental and legal aspects.
ПРН7	To apply modern tools and technologies for information retrieval, processing and analysis, in particular, statistical methods of analysis of large data and/or complex structure, specialized databases and information systems.
ПРН8	Ability to create methodological support, organize and conduct teaching of professionally-oriented disciplines at a level that meets the requirements of higher education.
8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) in the wording dated 23.05.2018. №347.
Material and technical support	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) in the wording dated 23.05.2018. №347.
Information, educational and methodical support	In accordance with the technological requirements for educational-methodological and informational support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (current) in the wording dated 23.05.2018. №347.
9 - Academic mobility	
National credit mobility	Possibility of concluding agreements on academic mobility and double graduation.

International credit mobility	Agreement on International Academic Mobility (Erasmus + K1) with Middle Eastern Technical University (Ankara, Turkey) Agreement on International Academic Mobility (Erasmus + K1) with the Polytechnic University (Valencia, Kingdom of Spain) Agreement between Igor Sikorsky KPI and the VISHWANIKETAN Institute from 01.12.2006 (India)
Training of foreign applicants for higher education	For foreign citizens, education is provided in English, and Ukrainian is studied as a foreign language.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code a/d	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Form of final control
1. REGULATORY			
Academic disciplines for acquiring general scientific (philosophical) competencies			
3O1	Philosophical principles of scientific activity	6.0	Credit, exam
Academic disciplines for acquiring language competencies			
3O 2	Foreign language for scientific activity	6.0	Credit, exam
Academic disciplines for acquiring in-depth knowledge of the specialty			
3O 3	Methods of intensification of heat and mass transfer processes in heterogeneous systems	4.0	Exam
3O 4	Features of thermodynamics of complex systems	4.0	Exam
3O 5	Low-cost technologies of increasing of complex efficiency of energy production	4.0	Exam
3O 6	Novel tendenties of development and technologies in power branch	4.0	Exam
Academic disciplines for acquiring universal competencies of the researcher			
3O 7	Organization of scientific-innovative activity	4.0	Exam
3O 8	Scientific investigations with modern soft applying and 3D modelling	3.0	Credit
3O 9	Pedagogical practice	2.0	Credit
2. SELECTIVE			
B 1	Educational component 1. F - Catalogue	6.5	Exam
B 2	Educational component 2. F - Catalogue	6.5	Exam
The total amount of **regulatory components**:		**37**	
Total volume of **selective components**:		**13**	
TOTAL VOLUME OF THE EDUCATIONAL COMPONENT OF THE PROGRAM		**50**	

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



4. SCIENTIFIC COMPONENT

Year of learning	The content of the PhD student's scientific work	Form of control
1 year	Choice and substantiation of the topic of the scientific research, determination of the content, terms of performance and volume of scientific works; choice and substantiation of the methodology of conducting of the research, making of review and analysis of existing views and approaches that have developed in modern science in the chosen field. Preparation and publication of at least 1 article (usually a review) in scientific professional journals (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Approval of the individual plan of the PhD student's work at the academic council of the institute/faculty, reporting on the progress of the individual PhD student's plan twice a year
2 year	Conducting the research under the guidance of the supervisor, which involves solving research problems through the use of a set of theoretical and empirical methods. Preparation and publication of at least 1 article in scientific professional journals (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting on the progress of the individual PhD student's plan twice a year
3 year	Analysis and generalization of the obtained results of the scientific research; substantiation of scientific novelty of the obtained results, their theoretical and/or practical significance. Preparation and publication of at least 1 article in scientific professional journals on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting on the progress of the individual PhD student's plan twice a year
4 year	Presentation of scientific achievements of the PhD student in the form of the dissertation, summing up concerning completeness of coverage of results of the dissertation in scientific articles according to the current requirements. Implementation of the obtained results and obtaining of supporting documents. Submission of documents for preliminary examination of the dissertation. Preparation of a scientific report for final certification (defense of the dissertation).	Reporting on the progress of the individual plan of the PhD student twice a year Providing an conclusion on the scientific novelty, theoretical and practical significance of the dissertation results.

5. FORM OF GRADUATE CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Graduation certification of applicants for higher education according to the educational program Heat power engineering specialty 144 Heat power engineering is carried out in the form of defense of the dissertation and ends with the issuance of a standard document on the award of the degree of Philosophy Doctor with the assignment of qualification: Philosophy Doctor of heat power engineering.

Qualification work is checked for plagiarism and after the defense is placed in the repository of University Scientific-Technical Biblioteque for free access. Graduation certification is carried out openly and publicly.

6. MATRIX OF CORRESPONDENCES

6.1. Matrix of correspondence of program competencies to the components of the educational component of the program

	ЗО1	ЗО2	ЗО3	ЗО4	ЗО5	ЗО6	ЗО7	ЗО8	ЗО9	В1	В2	Scientific component
ЗК1	+		+	+	+	+		+		+	+	
ЗК2		+										
ЗК3							+	+				+
ФК1		+		+		+				+	+	+
ФК2		+	+	+	+		+	+	+			
ФК3						+			+			+
ФК4			+	+	+			+		+	+	+
ФК5			+			+	+			+	+	
ФК6			+	+	+	+	+	+		+	+	

6.2. The matrix of providing of program learning outcomes with the relevant components of the educational component of the program

	ЗО1	ЗО2	ЗО3	ЗО4	ЗО5	ЗО6	ЗО7	ЗО8	ЗО9	В1	В2	Scientific component
ПРН1	+		+		+	+	+			+	+	+
ПРН2		+		+		+	+		+	+	+	
ПРН3			+	+	+				+			+
ПРН4							+	+		+	+	+
ПРН5				+	+			+		+	+	+
ПРН6			+		+		+			+	+	+
ПРН7			+		+			+		+	+	+
ПРН8		+				+			+			