

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"Igor Sikorsky Kyiv Polytechnic Institute"

APPROVED

*by Academic Council Igor Sikorsky Kyiv
Polytechnic Institute
(Minutes № 5 dated May 17, 2021)*

*Chairman of the Academic Council
Mykhailo Ilchenko*

EDUCATIONAL AND SCIENTIFIC PROGRAM

Power Machinery

third (educational – scientific) level of higher education

Specialty	142 Power Engineering
field of knowledge	14 Electrical Engineering
qualification	Doctor of Philosophy in Power Engineering

*Put into effect by order of the rector of
Igor Sikorsky Kyiv Polytechnic Institute
dated May 31, 2021, № HOH/143/2021*

Igor Sikorsky Kyiv Polytechnic Institute
Kyiv – 2021

PREFACE

Developed by the project team:

Chairman of the project team:

Tuz Valery Omelyanovich

Doctor of Technical Sciences , Professor, Professor of the Department of Nuclear Power Plants and Engineering Thermophysics

Project team members:

Lebed Natalia Leonidovna

Candidate of Technical Sciences Ph.D., Associate Professor, Associate Professor of the Department of Nuclear Power Plants and Engineering Thermophysics

Vorobiov Mykyta Valerievich,

Candidate of Technical Sciences Ph.D., Senior Lecturer of the Department of Nuclear Power Plants and Engineering Thermophysics

Rogachev Valery Andreevich

Candidate of Technical Sciences Ph.D., Associate Professor, Associate Professor of the Department of Nuclear Power Plants and Engineering Thermophysics

Marynenko Volodymyr Ivanovych

Candidate of Technical Sciences Ph.D., Associate Professor, Associate Professor of the Department of Nuclear Power Plants and Engineering Thermophysics,

Dudchenko Andrey Alexandrovich

student of the TC-91f group, Department of Nuclear Power Plants and Engineering Thermophysics

Head of the Department of Nuclear Power Plants and Engineering Thermophysics

Tuz Valery Omelyanovich

Doctor of Technical Sciences, Professor

Chairman of the scientific-methodical subcommittee of the university in the specialty

Tuz Valery Omelyanovich

Doctor of Technical Sciences, Professor of the Department of Nuclear Power Plants and Engineering Thermophysics

AGREED:

Scientific and methodical commission of Igor Sikorsky Kyiv Polytechnic Institute , specialty 142 "Power Machinery"

Chairman of the commission Valery TUZ

(Minutes № 5 dated February 11, 2021)

Methodical council of Igor Sikorsky Kyiv Polytechnic Institute

Chairman of the Methodical Council Yuriy YAKYMENKO

(Minutes № 7 dated May 13, 2021)

Professional expertise of interested persons (stakeholders) is taken into account:

Pentgenov I.V., Institute of Electric Welding named after E.O. Paton of the National Academy of Sciences of Ukraine, Department 56, Ph.D., Doctor of Technical Sciences, Professor.

Rymar S.V., Head of the Electrothermy Laboratory of the Paton Institute of Electric Welding of the National Academy of Sciences of Ukraine, Doctor of Technical Sciences, Senior Research Fellow.

Seagal O.I., Director of the Institute of Industrial Ecology, a full member of the Academy of Civil Engineering of Ukraine, Ph.D.

Korbut V.P., Department of Heat and Gas Supply and Ventilation, Kyiv National University of Construction and Architecture, Ph.D., Professor.

Demchenko V.G., Head of the Laboratory of Processes and Technologies for Support of the Institute of Technical Thermophysics of the National Academy of Sciences of Ukraine, Ph.D.

Paraftynyk V.P., a leading researcher of the Special Design Bureau of JSC "Sumy NGO-Engineering", Ph.D., Senior researcher.

Feedback reviews of stakeholders are attached.

According to the results of monitoring the educational-scientific program Power Machinery of the third (educational-scientific) level of higher education in the specialty 142 Power Machinery , approved by the decision of the Academic Council dated September 07, 2020, minutes № 6, taking into account the proposals of participants in the educational process, graduates, employers and other external stakeholders, it was updated.

The peculiarities of the educational program are specified, which focuses on providing training for specialists capable of independent research, research and innovation, organizational and managerial, pedagogical activities; and also takes into account the requirements of the draft Standard of Higher Education for the third (educational and scientific) level of higher education in the specialty 142 Power Machinery .

The project team reviewed the balance, rational allocation of loans, the ability of higher education seekers to effectively master its educational components and the entire educational program, the completeness of documentary, personnel, information and other support of educational program and compliance of the educational program with the License conditions. In particular: the list of normative educational components of the general training cycle has been updated; the volume of teaching in the block of selected educational components was redistributed. To optimize the mechanism of formation of an individual educational trajectory, the approach to the formation of a catalog of selective educational components has been revised, namely: standardization of such disciplines by the number of ECTS credits has been carried out. The requirements of the Resolution of the Cabinet of Ministers of Ukraine of June 25, 2020 № 519 (new version of the "National Qualifications Framework") have been taken into account.

Educational program was discussed after receipt of all wishes and suggestions from stakeholders and approved at an extended meeting of the Department of Nuclear Power Plants and Engineering Thermophysics (Minutes № 13 dated February 09, 2021).

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1. PROFILE OF THE EDUCATIONAL PROGRAM

in the specialty 142 Power Engineering

1 - General information	
Complete of the Higher Education Institution (HEI) / faculty	National Technical University of Ukraine, Igor Sikorsky Kyiv Polytechnic Institute, Faculty of Thermal Power Engineering
Higher education degree and title of qualification in the original language	Degree of higher education – Doctor of Philosophy Educational qualification – Doctor of Philosophy in Power Engineering
The official name of the educational program	Educational program "Power Machinery " of the third (educational and scientific) level of higher education
Type of diploma and scope of educational program	Doctor of Philosophy. Training period 4 years. Educational component 30 credits ECTS. The scientific component involves conducting your own research and design of its results in the form of a dissertation.
Availability of accreditation	Not accredited, accredited for the first time, accreditation is scheduled for 2021.
Cycle / level of Higher Education (HE)	NRC of Ukraine – level 8 QF-EHEA – the third cycle EQF-LLL – level 8
Prerequisites	Having a master’s degree or specialist degree
Language (s) of instruction	Ukrainian / English
Term of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	http://aesitf.kpi.ua/ / section Educational programs https://osvita.kpi.ua/ / section Educational programs
2 - The purpose of the educational program	
<p>Training of highly qualified, competitive, integrated into the European and world scientific and technical space specialists of the degree of Doctor of Philosophy in Power Machinery , capable of independent research, scientific-innovative, organizational-managerial, pedagogical activity in the field of technical sciences in specialty 142 "Energy" and related industries, in higher education institutions, through the internationalization of the educational process in terms of sustainable innovative scientific and technological development of society and is implemented through:</p> <ul style="list-style-type: none"> - harmonious and multidimensional education of future highly qualified technical specialists, able to comprehensively and systematically analyze the problems of Power Machinery and related industries, 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. 	

3 - Characteristics of the educational program

Subject area	<p><u>Objects of study and activity:</u> Processes of heat and mass transfer, hydrodynamics and aerodynamics and heat stress, which occur in power plants, units and machines.</p> <p><u>Learning objectives:</u> Training of professionals who are able to set and solve complex problems in the field of Power Machinery and research and innovation, which involves a deep rethinking of existing and the creation of new holistic knowledge and professional practice.</p> <p><u>Theoretical content of the subject area:</u> principles, concepts and theories of processes and production of industrial equipment for generation, transformation and transmission of thermal energy.</p> <p><u>Methods, techniques and technologies:</u> -methods of thermodynamic analysis of complex energy systems and installations operating on reverse and direct thermodynamic cycles; -methods of experimental studies of processes occurring in power plants; -calculation and experimental methods for assessing the structural strength and reliability of energy, technological and other machines, devices and apparatus of the field of Power Machinery .</p> <p><u>Tools and equipment:</u> modern power equipment, equipment, machinery, control and measuring devices of technological processes in power equipment; computer equipment and application packages for measuring and processing experimental data on the study of processes and phenomena in the equipment of complex energy systems.</p>
Orientation of the educational program	Educational - scientific
The main focus of the educational program	<p>Special education in the field of knowledge 14 Electrical engineering in the specialty 142 Power engineering</p> <p>Acquisition of educational qualification for scientific-innovative and scientific-pedagogical professional activity in the field of power engineering. The program is based on well-known scientific principles, taking into account the current state of development of Power Machinery and energy. 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,</p> <p>Keywords: research and innovation in the field of Power Machinery , heat and mass transfer and hydroaerodynamic processes, energy and resource conservation.</p>
Features of the program	<p>Interdisciplinary scientific-innovative and multidisciplinary training of specialists in the field of Power Machinery . Passage by students of scientific and practical internship in the profile at specialized enterprises and mastering of modern engineering technologies of computer design of thermal power systems. The implementation of the program involves the involvement of practitioners, industry experts, employers' representatives and other stakeholders in the educational process. Participation of students in the Summer Specialized Schools of Energy and Power Engineering and student research groups. Some special courses can be taught in English (foreign).</p>

4 - Suitability of graduates for employment and further study

Suitability for employment	<p>The specialist is prepared to work in the field of Power Machinery in accordance with the National Classification of Ukraine: Classifier of professions DK 003: 2010.</p> <p>Specialist by qualification level of works: 2149.1 Researcher (engineering), 2310.2 Teacher of a higher educational institution</p>
Further training	<p>Continuing education in doctoral studies and / or participation in postdoctoral programs.</p>

5 - Teaching and assessment

Teaching and learning	<p>Student-centered learning, self-study, problem-oriented learning, learning through laboratory practice.</p> <p>All participants in the educational process are provided with timely and understandable information on the goals, content and program learning outcomes, the procedure and evaluation criteria within the individual educational components.</p> <p>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 classes, application of information and communication technologies for individual educational components, blended learning technology, practice and excursions; conducting research; performing a doctoral dissertation; holding regular conferences, seminars, colloquia, access to the use of laboratories, equipment, etc.</p>
Evaluation	<p>Current and semester control in the form of presentations, essays, written and oral examinations and defense of qualification work are evaluated in accordance with the defined criteria of the Rating system.</p>

6 - Program competencies	
Integral competence	Ability to formulate and solve complex problems in the field of professional and / or research and innovation activities in the field of Power Machinery , which involves a deep rethinking of existing and the creation of new holistic knowledge and / or professional practice
General Competences (GC)	
GC1 Ability to abstract thinking, analysis and synthesis.	
GC2 Ability to search, process and analyze information from various sources.	
GC3 Ability to work in an international context.	
GC4 Ability to generate new ideas.	
GC5 Definiteness and persistence in terms of tasks and responsibilities.	
Professional Competencies (PC)	
PC1	Ability to perform original research, achieve scientific results that create new knowledge in the field of Power Machinery and related interdisciplinary areas and can be published in leading scientific journals in Power Machinery and related fields.
PC2	Ability to orally and in writing present and discuss the results of research and / or innovative developments in Ukrainian and foreign languages, deep understanding of foreign scientific texts in the field of research.
PC3	Ability to use modern information technologies, databases and other electronic resources, specialized software in scientific and educational activities.
PC4	Ability to initiate, develop and implement complex innovative projects in the field of Power Machinery and related interdisciplinary projects.
PC5	Ability to formulate a scientific problem (task) that has theoretical and practical significance in the field of Power Machinery , to determine ways to solve it with the involvement of modern theoretical and experimental methods and information technology.
PC6	Ability to achieve the ultimate goal of the study - the practical implementation or prospects of such in the perspective of theoretical science.
PC7	Ability to carry out scientific and pedagogical activities in higher education institutions on Power Machinery .
PC8	Ability to use the latest advances in modern science and advanced technologies in research.
PC9	Ability to develop, apply and improve mathematical models, scientific and technical methods and modern computer software for solving complex problems in technical and natural systems.

7 - Learning Outcomes of the Program (LOP)

- LOP 1** Have advanced conceptual and methodological knowledge in Power Machinery and at the boundaries of subject areas, as well as research skills sufficient to conduct scientific and applied research at the level of the latest world achievements, gain new knowledge and / or implement innovations.
- LOP 2** Freely present and discuss with experts and non-specialists the results of research, scientific and applied problems of Power Machinery in state and foreign languages, qualified to reflect the results of research in scientific publications in leading domestic and international scientific journals.
- LOP 3** Formulate and test hypotheses; use appropriate evidence to substantiate the conclusions, in particular, the results of theoretical analysis, experimental research and mathematical and / or computer modeling, available literature data.
- LOP 4** Develop and research conceptual, mathematical and computer models of processes and systems, use them effectively to gain new knowledge and / or create innovative products in the field of Power Machinery and related interdisciplinary areas.
- LOP 5** Plan and perform experimental and / or theoretical research in Power Machinery and related interdisciplinary areas using modern tools, critically analyze the results of their own research and the results of other researchers in the context of the whole set of modern knowledge about the problem.
- LOP 6** Apply modern tools and technologies for searching, processing and analyzing information, in particular, statistical methods of data analysis of large volumes and / or complex structures, specialized databases and information systems.
- LOP 7** Based on the results of theoretical and experimental research to develop and implement scientific and / or innovative engineering projects that provide an opportunity to rethink existing and create new holistic knowledge and / or professional practice and solve significant scientific and technological problems in Power Machinery in compliance with academic standards. ethics.
- LOP 8** Deeply understand modern problems of scientific and technical development of science and technology, taking into account world achievements in the fields of energy and Power Machinery, taking into account technical, economic and environmental areas, know and apply modern technologies of energy and resource conservation.
- LOP 9** Ability to organize and conduct teaching of professionally-oriented disciplines and develop methodological support at a level that meets the requirements of higher education.

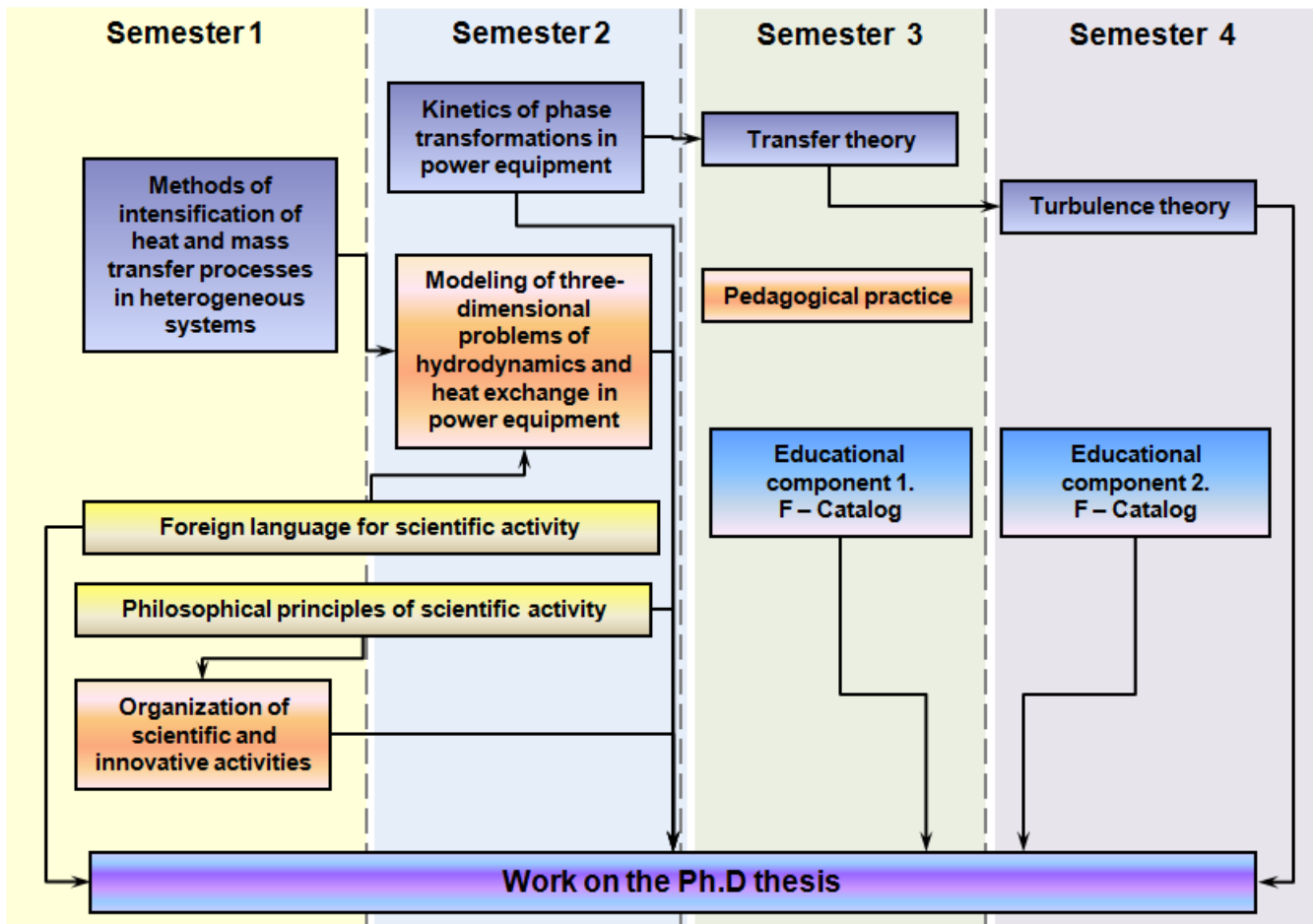
8 - Resource support for program implementation	
Staffing support	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine in current edition. The implementation of the program involves the involvement of practitioners, industry experts, employers' representatives and other stakeholders in the educational process.
Logistical 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 in current edition. In training specialists use modern software: Compass, Ansis, Tekla Structure, and Autodesk Inventor.
Information, educational and methodical support	In accordance with the technological requirements for educational and methodological and information support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine in current edition. Resources of the GI Denisenko Scientific and Technical Library of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" are used in the organization and conduct of the educational process. https://www.library.kpi.ua/

9 - Academic mobility	
National credit mobility	Possibility of concluding agreements on academic mobility and double diplomacy.
International credit mobility	Possibility of concluding agreements on international academic mobility (Erasmus + K1), on double graduation, on long-term international projects, etc., which provide for the included education of students. Internship agreement with Froling, Griekirch, Austria.
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 n / a	Components of the educational program (disciplines, practices, qualification work)	Number of credits ECTS	Form final control
1. MANDATORY (regulatory) components of the educational program (EP)			
1.1. General training cycle			
1.1.1. Educational disciplines for mastering general scientific (philosophical) competencies			
M 1	Philosophical principles of scientific activity	6.0	credit, exam
1.1.2. Educational disciplines for acquiring language competencies			
M 2	Foreign language for scientific activity	6.0	test, examination
1.1.3. Educational disciplines for obtaining in-depth knowledge of the specialty			
M 3	Methods of intensification of heat and mass transfer processes in heterogeneous systems	4.0	examination
M 4	Kinetics of phase transformations in power equipment	4.0	examination
M 5	Transfer theory	4.0	examination
M 6	Turbulence theory	4.0	examination
1.1.4. Educational disciplines for the acquisition of universal competencies of the researcher			
M 7	Organization of scientific and innovative activities	3.0	examination
M 8	Modeling of three-dimensional problems of hydrodynamics and heat exchange in power equipment	3.0	test
M 9	Pedagogical practice	2.0	test
2. SELECTIVE components of the educational program (EP)			
S 1	Educational component 1. F – Catalog	7.0	examination
S 2	Educational component 2. F – Catalog	7.0	examination
Total mandatory components:		36	
Total components of selective components:		14	
Total amount of the educational component program:		50	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. SCIENTIFIC COMPOSITION

Year of preparation	The content of the graduate student's scientific work	Form of control
1 year	The choice of the topic of the graduate student's dissertation, the formation of an individual work plan of the graduate student; execution of the dissertation work under the guidance of the scientific supervisor; preparation and submission for publication of at least 1 publication on the topic of the dissertation in accordance with current requirements.	approval by the academic council of the institute / faculty, reporting on the implementation of the individual plan of the graduate student twice a year
2 years	Execution under the guidance of the supervisor of the dissertation; preparation and submission for publication of at least 1 publication on the topic of the dissertation in accordance with current requirements.	reporting on the progress of the individual graduate student's plan twice a year
3 years	Execution under the guidance of the supervisor of the dissertation; preparation and submission for publication of at least 1 publication on the topic of the dissertation in accordance with current requirements.	reporting on the progress of the individual graduate student's plan twice a year
4 years	Completion of the dissertation, summarizing the results of publications (at least three) on the topic of the dissertation in accordance with current requirements. Submission of documents for preliminary examination of the dissertation. Graduation certification	reporting on the progress of the individual plan of the graduate student twice a year Providing an opinion on the scientific novelty, theoretical and practical significance of the dissertation results. Presenting a PhD thesis

5. FORM OF CERTIFICATION OF APPLICANTS OF HIGHER EDUCATION

Certification of applicants for higher education according to the educational and scientific program Power Machinery specialty 142 Power Machinery 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 Doctor of Philosophy with the qualification: Doctor of Philosophy Power Machinery .

Qualification work is checked for plagiarism and after defense is placed in the repository of STB University for free access. Certification is carried out openly and publicly.

6. MATRIX OF MATCHES

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

	ZO 1	ZO 2	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Scientific component
GC1	+				+	+				
GC2	+	+	+							+
GC3		+					+			
GC4			+			+				+
GC5							+			+
PC1					+					
PC2		+					+		+	+
PC3							+	+		+
PC4			+							
PC5			+	+		+				+
PC6				+			+			
PC7									+	
PC8				+				+		+
PC9					+			+		

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

	ZO 1	ZO 2	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	Scientific component
LOP1	+		+	+						
LOP2		+					+			+
LOP3			+	+		+				+
LOP4					+	+		+		+
LOP5				+			+			+
LOP6		+						+		+
LOP7				+		+				+
LOP8	+	+	+		+		+			+
LOP9							+		+	