

**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,  
protocol No. \_\_\_\_, dated \_\_\_\_\_

Academic Council Chairman  
Mykhailo ILCHENKO

# **Automation and computer integrated technologies**

## **EDUCATIONAL AND SCIENTIFIC PROGRAM**

**third (PhD) higher education level**

<b>Speciality</b>	<b>151 Automation and Computer Integrated Technologies</b>
<b>Field of Study</b>	<b>15 Automation and Instrumentation Engineering</b>
<b>Qualification</b>	<b>Philosophy Doctor of Automation and Computer Integrated Technologies</b>

Enacted from 2022/2023 academic year  
by order of the Rector of KPI. I. Sikorsky,  
form \_\_\_\_\_p. № NON\_\_\_\_\_

Kyiv – 2022

## PREAMBLE

### DEVELOPED project group:

#### *Project team Chairman:*

*Prof. Anatolii Zhuchenko*, Doctor of Technical Science, Associate Professor,  
Head of Automation Hardware and Software Department

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#### *Project team members:*

*Dr. Volodymyr Voloshchuk*, Doctor of Technical Science, Associate Professor,  
acting as the Head of Heat Power Engineer Department.

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*Prof. Yurii Kuts*, Doctor of Technical Science, Professor, Professor of NDT  
Instruments and Systems Department

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*Dr. Dmytro Kovalyuk*, Candidate of Technical Sciences, Associate Professor,  
Associate Professor of Automation Hardware and Software Department,

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*Dr. Denys Skladannyi*, Candidate of Technical Sciences, Associate Professor,  
Associate Professor of Automation Hardware and Software Department,

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*Dr. Maryna Philipova* Candidate of Technical Sciences, Associate Professor,  
Associate Professor of Device production department

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*Vadym Lebid*, technical director of the Private enterprise "Artesia",  
representative of employers.

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*Mykola Khibeba*, graduate student of study group 151-f61, applicant

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### AGREED:

*Scientific and Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute for  
speciality 151 Automation and Computer Integrated Technologies*

Head of the SMB-151

Prof. Anatolii Zhuchenko

*(Protocol No. 3 dated December 7, 2021)*

*Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute*

Methodological Council Chairman

Prof. Yuriy YAKYMENKO

*(Protocol No. \_\_\_\_ dated \_\_\_\_\_)*

**CONSIDERED:**

1. Higher Education Standard (draft project) in the specialty 151 «Automation and computer-integrated technologies», is posted on the Ministry of Education and Science Ukraine website of the for public discussion.
2. Scientific and pedagogical workers suggestions of graduating departments of engineering-chemical, instrument-making, and heat power faculties.
3. Stakeholders comments and suggestions based on the public discussion results:
  - a. higher education applicants who study in educational programs of specialty 151 «Automation and computer-integrated technologies»;
  - b. specialists of the Igor Sikorsky Kyiv Polytechnic Institutes Department of the Educational Process Quality and the Department of the Educational Process Organization.
  - c. specialists in automation and computer-integrated technologies (reviews, reviews and letters are attached).

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# 1. EDUCATIONAL PROGRAM PROFILE

## Speciality 151 Automation and Computer Integrated Technologies

1 – General Information	
Higher education institution full name, faculty	National Technical University of Ukraine, Igor Sikorsky Kyiv Polytechnic Institute, Faculty of Chemical Engineering
Higher education degree and the qualification title	Degree – PhD Qualification – Philosophy Doctor of Automation and Computer Integrated Technologies
Educational program official name	Automation and Computer Integrated Technologies
Diploma type and educational program scope	PhD diploma, Training period 4 years. <u>Educational component</u> 48 ECTS credits. <u>Scientific component</u> provides own research and completing text of PhD Thesis which describes the most significant research results.
Existing accreditation	The program has no accreditation. Accreditation is planned by National Higher Education Quality Assurance Agency in 2021
Levels	NRC of Ukraine – 8 level. QF-EHEA – third cycle. EQF-LLL – 8 level
Prerequisites	Master degree
Мова(и) викладання	Ukrainian / English
Educational program term	Until accreditation
Educational program Internet address	<a href="https://osvita.kpi.ua/151">https://osvita.kpi.ua/151</a> <a href="https://pbf.kpi.ua/ua/category/documents/eduprog/151-automation/">https://pbf.kpi.ua/ua/category/documents/eduprog/151-automation/</a> <a href="https://pbf.kpi.ua/ua/">https://pbf.kpi.ua/ua/</a> <a href="https://tpza.kpi.ua/osvitni-program">https://tpza.kpi.ua/osvitni-program</a> <a href="https://atep.kpi.ua/educationals-programs/">https://atep.kpi.ua/educational-programs/</a>
2 – Educational program purpose	
<p>Training, in accordance with the University Strategy, highly qualified, competitive, integrated into the European and world scientific, technical and educational space specialists with PhD degree in automation and computer-integrated technologies, who are able to define, formulate, summarize and solve scientific and practical tasks; to have fundamental and applied research methods in automation and computer-integrated technologies, as well as are able to effectively solve innovative problems of the appropriate level, to carry out pedagogical activities in the specialty, work in higher education institutions, research institutions and leading enterprises in Ukraine and abroad</p>	

### 3 – Характеристика освітньої програми

Предметна область	<p><i>Activity object:</i> control objects and processes (technological processes, productions, organizational structures), technical, informational, mathematical, software and organizational support of automation systems in various fields.</p> <p><i>Learning objectives:</i> training of specialists in field of automation and computer-integrated technologies, who are able to solve complex scientific problems providing innovation activities in the field of automation and computer-integrated technologies, which involves a deep rethinking of existing and creation of new holistic knowledge and/or professional practice.</p> <p><i>Subject area theoretical content:</i> concepts and methodologies of synthesis, design, automation objects and systems studying based on the methods and principles of systems analysis, modern control theory, information theory, mathematical modeling and optimization, theory of algorithms as well as artificial intelligence.</p> <p><i>Methods, techniques and technologies:</i> state of the art methods of theoretical and experimental research, synthesis, design, control systems setup; methods and instruments for research projects management, presenting results of the research, protection of intellectual property, higher education methodology.</p> <p><i>Tools and equipment.</i> Computer and information technologies, microprocessors, specialized software for automated systems design and maintenance. Specialized software and technical means providing experiments automation.</p>
Educational program orientation	Educational and scientific
Educational program main focus	<p><i>Special education</i> in the automation and instrumentation field, specializing in automation and computer-integrated technologies.</p> <p>The program is based on the existing state of the art scientific provisions, taking into account the current state of the science in field of automation and computer-integrated technologies, focused on current knowledge, skills and experience, within which further professional and scientific career is possible.</p> <p><i>Keywords:</i> automation, computer-integrated technologies, automation technical means, optimization, control systems.</p>

Program features	<ul style="list-style-type: none"> <li>– The program is focused on systematic comprehensive specialists training capable of organizing and conducting research, search for non-standard innovative solutions in automation and computer-integrated technologies.</li> <li>– The program is based on the results of scientific schools to automate processes and technologies of various orientations, combined with the applied needs of enterprises in relevant industries.</li> <li>– The program ensures the relevance of the content of the educational process and research to the current state of science in the field and the applied orientation through learning through research.</li> <li>– Scientific and practical competencies of applicants are focused on solving new scientific and practical problems due to the industries integration at the fourth industrial revolution</li> </ul>
<b>4 – Graduates suitability for employment and further study</b>	
Suitability for employment	<p><i>Types of economic activity</i> (according to the Types of economic activity Classifier DK 009:2010)</p> <ul style="list-style-type: none"> <li>– 72.1. Investigation and development in fields on Natural and Technical sciences.</li> <li>– 85.42. Higher education.</li> </ul> <p><i>Professional qualification</i> (according to the Professions Classifier DK 003:2010)</p> <ul style="list-style-type: none"> <li>2310.2 – University lecturer;</li> <li>– 2131.1 – Researcher (computational systems);</li> <li>– 2131.1 – Consultant-researcher (computational systems)</li> <li>– 2131.2 – Research engineer in automation and computer systems;</li> </ul>
Further study	<p>Continuing postdoctoral research or participating postdoctoral fellowship programs.</p> <p>Lifelong learning for development and self-improvement in professional and scientific, teaching activity spheres, acquisition of additional qualifications in the adults education system .</p>

<b>5 – Teaching and assessment</b>	
Teaching and learning	<ul style="list-style-type: none"> <li>– lectures, practical and seminar classes, computer workshops, laboratory works, interactive workshops in classroom, distance, mixed form;</li> <li>– conducting classrooms with the professionals-practitioners involvement, including in the territories of partner companies;</li> <li>– participation in scientific, scientific and technical international and interdisciplinary conferences, seminars, projects, trainings;</li> <li>– independent work with the use of methodological and scientific information sources;</li> <li>– participation in research project development groups;</li> <li>– consultations with scientific and scientific-pedagogical workers.</li> </ul> <p>Preparation for <i>teaching</i> include semester pedagogical practice under the guidance of highly qualified teachers (professors).</p> <p>The implementation of the <i>scientific component</i> of the program is carried out under the guidance of the supervisor. Specialized laboratories available at the institution are used to conduct research. Approbation of the results of the scientific component is carried out at seminars and scientific conferences.</p>
Assessment	<p>Current and semester control of the <i>teaching component</i> in the laboratory reports, presentations, and essays form, written and oral exams. Rating system.</p> <p>The results of the <i>scientific component</i> are assessed according the results of the annual reports, final results must be defended as the PhD Thesis.</p>
<b>6 – Program competencies</b>	
Total competence	Ability to solve complex problems in the automation and computer-integrated technologies field, in research, study and profession activity which involves deep rethinking of the existing and developing new complete knowledges as well as professional practice.
General competencies (GC)	<p>GC01. Ability to abstract thinking, analysis and synthesis</p> <p>GC02. Ability to generate new ideas (creativity).</p> <p>GC03. Knowing and deep understanding of the subject area, understanding of the professional and research activity.</p> <p>GC04. Ability to work in an international context.</p>
Special competencies (SC)	<p>SC01. Ability to perform original research, achieve scientific results that create new knowledge in the field of automation and computer-integrated technologies and related interdisciplinary areas and can be published in top-ranking scientific journals in automation, computer technology, instrumentation and related fields.</p> <p>SC02. Ability to orally and in writing present and discuss the results of research and / or innovative developments in Ukrainian and English, a deep understanding of English scientific texts in the field of research.</p> <p>SC03. Ability to apply state of the art methods of research, synthesis, design of automation systems, computer-integrated technologies, their</p>



	<p>software and hardware components, specialized software in scientific and educational activities.</p> <p>SC04. Ability to carry out scientific and pedagogical activities in higher education, to adhere to research ethics, as well as the rules of academic integrity in scientific research and scientific and pedagogical activities.</p> <p>SC05. Ability to initiate, develop and implement comprehensive innovative projects in the field of automation and computer-integrated technologies and related interdisciplinary projects, leadership in their implementation.</p> <p>SC06. Systematic scientific worldview and general cultural outlook.</p>
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**7 – Program learning results (PR)**

	<p>PR01. Have advanced conceptual and methodological knowledge of automation and computer-integrated technologies at the cross-border areas, as well as research skills sufficient for scientific and applied research at the level of modern world achievements in automation and computer-integrated technologies, obtaining new knowledge and / or innovation.</p> <p>PR02. Freely present and discuss with specialists and non-specialists the results of research, scientific and applied problems of automation and computer-integrated technologies in state and foreign languages, qualified to reflect the results of research in scientific publications in leading international scientific journals.</p> <p>PR03. Develop and research conceptual, mathematical and computer models of processes and systems, effectively use them to gain new knowledge and / or create innovative developments in the field of automation and computer-integrated technologies and related interdisciplinary areas.</p> <p>PR04. Plan and perform experimental and / or theoretical studies of automation systems, computer-integrated systems and their components using modern research methods, hardware and software, critically analyze the results of their own research and the results of other researchers in the context of the whole complex of modern knowledge. .</p> <p>PR05. 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 of automation and computer-integrated technologies in compliance with academic ethics and taking into account social, economic, environmental and legal aspects.</p> <p>PR06. Be able to apply modern methods of analysis, synthesis, design in the study of automation systems, computer-integrated technologies, their software and hardware components.</p> <p>PR07. Possess modern methods of pedagogical activity in higher education; be able to teach professionally-oriented disciplines of the specialty on the basis of systemic, methodological knowledge of automation and computer-integrated technologies and research results.</p>
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<b>8 – Resource support for program implementation</b>	
Staffing	According to the personnel requirements for staffing the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (effective) as amended on 23.05.2018 № 347.
Logistics	According to the personnel requirements for logistics the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 (effective) as amended on 23.05.2018 № 347.
Інформаційне та навчально-методичне забезпечення	According to the personnel requirements for information and methodical support the implementation of educational activities for the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (effective) as amended on 23.05.2018 №347. Using the library funds, electronic repository, and university distancelearning platform.
<b>9 – Academic mobility</b>	
National mobility	Possibility of concluding agreements on academic mobility according to the current higher education legislation of Ukraine.
International mobility	Academic mobility program Erasmus +, opportunity to participate in of the university’s academic mobility programs on a competitive basis.
Foreign applicants education	Studying is providing in English and Ukrainian languages. Ukrainian is studied as a foreign language.

## 2. EDUCATIONAL COMPONENT OF THE PROGRAM

Code	Educational Components (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Distribution
1	2	3	4
<b>Compulsory educational components</b>			
<i>General courses for acquiring general scientific (philosophical) competencies</i>			
H 1	Philosophical principles of scientific activity	6	exam
<i>Courses for acquiring language competencies</i>			
H 2	Foreign language for scientific activity	6	exam
<i>Courses for obtaining deep knowledge of the specialty</i>			
H 3	Research methodology in scientific field	4	final tests
H 4	Special Control Theory	4	exam
H 5	Control systems Software and Hardware	4	exam
H 6	Control systems objects modeling and optimization	4	exam
<i>Courses for obtaining universal researcher competencies</i>			
H 7	Organization of scientific and innovative activities	4	final tests
H 8	Pedagogical practice	4	final tests
<b>Optional educational components</b>			
B 1	Educational Components #1 from Faculty catalogue	6	final tests

1	2	3	4
B 2	Educational Components #2 from Faculty catalogue	6	final tests
<b>The total volume of the compulsory educational components:</b>		<b>36</b>	
<b>The total volume of the optional educational components:</b>		<b>12</b>	
<b>THE TOTAL VOLUME OF THE EDUCATIONAL PROGRAM</b>		<b>48</b>	

### 3. SCIENTIFIC COMPONENT OF THE PROGRAM

Year of training	Content of the PhD student's research activity	Distribution
1	2	3
1 year	Choice and substantiation of the topic of own scientific research, determination of the content, terms of performance and volume of scientific works; selection and substantiation of the methodology of conducting own research, 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 publications (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Approval of the PhD student's individual plan by the academic council of the institute / faculty, reporting on the progress of the individual PhD student's plan twice a year
2 year	Conducting own 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 publications (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting about the progress of the individual PhD student's plan twice a year
3 year	Analysis and generalization of the obtained results of own 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 publications on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting about the progress of the individual PhD student's plan twice a year
4 year	Registration of scientific achievements of the post-graduate 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 receipt 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 about the progress of the individual PhD student's plan twice a year. Providing a summary on the scientific novelty, theoretical and practical significance of the research results

## 4. EDUCATIONAL PROGRAM STRUCTURE AND LOGICAL SCHEME



