

**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. 3, dated March 15, 2021

Academic Council Chairman  
Mykhailo ILCHENKO

**AUTOMATION HARDWARE AND  
SOFTWARE**

**EDUCATIONAL AND PROFESSIONAL PROGRAM**

**Second (master) 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>Master of Automation and Computer Integrated Technologies</b>

Enacted from 2021/2022 academic year  
by order of the Rector of KPI. I. Sikorsky,  
form April 19, 2021p. № NON/89/2021

## **PREAMBLE**

### **DEVELOPED project group:**

#### *Project team Chairman:*

*Dr. Vitaii Tsapar*, Candidate of Technical Sciences, Associate Professor, Associate Professor of Automation Hardware and Software Department

#### *Project team members:*

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

*Dr. Mykhaylo Korzhyk*, Candidate of Technical Sciences, Associate Professor, Associate Professor of Automation Hardware and Software Department,

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

*Prof. Olexander Samkov*, Doctor of Technical Science, Senior Research Fellow, Head's Assistant of the Institute of Electrodynamics of National Academy of Sciences of Ukraine

*Andriy Shaposhnik*, student, group LA-01mp

### **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. Anatoliy Zhuchenko

*(Protocol No. 1 dated February 9, 2021)*

*Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute*

Methodological Council Chairman

Prof. Yuriy YAKYMENKO

*(Protocol No. 6 dated February 25, 2021)*

## **CONSIDERED:**

Reviews, reviews (attached to the OP), suggestions from stakeholders:

automated production control systems Service of PJSC "Myronivska Poultry Farm", Myronivka, Kyiv region. (signed: leading engineer E.M. Tymoshenko, engineer R.V. Kravchuk)

«Vetcontrol» Ltd, Kyiv (signed by Director I.O. Demchenko);

Master's training last year students in 2020, who study in the educational and professional program

After receiving all the wishes and suggestions of stakeholders, the educational and scientific program discussed at a Hardware and Software Department meeting (*protocol No. 8 dated January 28, 2021*)

# CONTENT

1. Профіль освітньої програми .....	5
2. Перелік компонент освітньої програми .....	9
3. Структурно-логічна схема освітньої програми .....	10
4. Форма атестації здобувачів вищої освіти.....	<b>Ошибка! Закладка не определена.</b>
5. Матриця відповідності програмних компетентностей компонентам освітньої програми.....	<b>Ошибка! Закладка не определена.</b>
6. Матриця забезпечення програмних результатів навчання відповідними компонентами освітньої програми.....	<b>Ошибка! Закладка не определена.</b>

# 1. EDUCATIONAL PROGRAM PROFILE

## Speciality 151 Automation and Computer Integrated Technologies

<b>1 – General Information</b>	
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 – Master Qualification – Master of Automation and Computer Integrated Technologies
Educational program official name	Automation Hardware and Software
Levels	NRC of Ukraine – level 7, QF-EHEA – second cycle, EQF-LLL – level 7.
Diploma type and educational program scope	Master's degree, single, 90 credits, term of study 1 year, 4 months
Accreditation	Accreditation certificate ND-IV № 1158059, issued by the Ministry of Education and Science of Ukraine on June 4, 2013 (2070-L), valid until July 1, 2023.
Prerequisites	Bachelor's degree
Study language(s)	Ukrainian
Educational program term	Until the next accreditation
Educational program Internet address	<a href="https://tpza.kpi.ua/">https://tpza.kpi.ua/</a> , page <i>Educational programs</i> <a href="https://osvita.kpi.ua/">https://osvita.kpi.ua/</a> , page <i>Educational programs</i>
<b>2 – Educational program purpose</b>	
<p>Training of highly qualified competitive specialists with a master's degree in automation and computer-integrated technologies capable in creating modern scientific knowledge, solving complex specialized tasks, doing scientific and innovative activities, which involves the implementation of intercultural interaction with members of the scientific and technological community in terms of technological progress and society sustainable development, internationalization the education and transformation the labour market, comprehensive professional, intellectual, social and creative individual development in the educational and scientific environment.</p>	

<b>2 – Educational program characteristics</b>	
Subject area	<p><i>The study and activity objects</i> of masters in automation and computer-integrated technologies are control processes and objects (technological processes, production, organizational structures), technical, informational, mathematical, software and organizational of automation systems support in various fields.</p> <p><i>Learning objectives:</i> training the engineers and scientists capable in complex solutions in problems of creation, improvement, modernization, operation and maintenance of automation systems, their components, cyber-physical systems, digital transformation technologies behind the tasks of Industry 4.0, contribute to the enterprises and companies products and services rapid adaptation, as well as provide the transition from the physical to the digital world.</p> <p><i>Subject area theoretical content:</i> automatic control theory concepts and principles, automation systems development and computer-integrated technologies principles.</p> <p><i>Methods, techniques and technologies.</i> Analysis and synthesis methods; automation and computer-integrated and cyber-physical technologies systems design, commissioning, modernization, operation and maintenance; scientific research methodology of automation systems and objects control; complex organizational and technical objects.</p> <p><i>Tools and equipment.</i> Digital and network technologies, microprocessors, programmable logic controllers (PLC), embedded digital devices and systems (Embedded Systems), intelligent mechatronic and WLAN-compatible Internet of Things (IoT) technology components, specialized software for automation systems design, development and operation.</p>
Educational program orientation	Educational and professional
Educational program main focus	<p><i>Special education</i> in the automation and instrumentation field, specializing in automation and computer-integrated technologies with a focus on creating intelligent, adaptive and robust control systems for resource- and energy-efficient technological processes and production in various industries and research.</p> <p><i>Keywords:</i> automation, computer-integrated technologies, control object, technological process, control system, technological processes, modelling.</p>
Program features	<p>Interdisciplinary and multidisciplinary specialists training in automation and computer-integrated technologies, with a focus on creating intelligent, adaptive and robust control systems for resource- and energy-efficient technological processes and systems.</p> <p>Involvement of specialists from other educational institutions and IT companies in education process.</p> <p>Carrying out of practice of students on manufactures.</p> <p>Participation of higher education students in student research groups.</p> <p>Ability to study individual courses in English.</p>

<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>– 62.01. Computer programming;</li> <li>– 62.03. Computer equipment management activities;</li> <li>– 62.09. Other activities in information technology and computer systems</li> </ul> <p><i>Professional qualification</i> (according to the Professions Classifier DK 003:2010)</p> <ul style="list-style-type: none"> <li>– 2131.2. Automated Control Production Systems Engineer;</li> <li>– 2131.2. Computer Software Engineer;</li> <li>– 2131.2 Computer Systems and Automation Research Engineer;</li> <li>– 2139.2. Computer Application Engineer;</li> <li>– 2145.2. Production Processes Mechanization and Automation Engineer</li> <li>– 2149.1 Researcher (engineering);</li> </ul>
Further study	<p>Further education according to the doctor of philosophy program at the third educational and scientific higher education level.</p> <p>Lifelong education in professional and scientific spheres of activity for development and self-improvement, additional qualifications acquisition in the adult education system.</p>
<b>5 – Teaching and assessment</b>	
Teaching and learning	Завдання-орієнтований підхід. Викладання проводиться у формі: лекції, семінари, практичні заняття, лабораторні заняття в малих групах (до 12 осіб), самостійна робота з можливістю консультацій з викладачем, індивідуальні заняття, застосування інформаційно-комунікаційних технологій за освітніми компонентами
Assessment	Поточний та семестровий контроль вигляді лабораторних звітів, презентацій, есе, письмових і усних екзаменів. Рейтингової системи оцінювання.
<b>6 – Program competencies</b>	
Total competence	Здатність розв'язувати складні задачі і проблеми автоматизації та комп'ютерно-інтегрованих технологій у професійній діяльності та/або у процесі навчання, що передбачає проведення досліджень та/або провадження інноваційної діяльності та характеризується комплексністю та невизначеністю умов і вимог.
<b>General competencies (GC)</b>	
GC 1	Здатність проведення досліджень на відповідному рівні
GC 2	Здатність генерувати нові ідеї (креативність).
GC 3	Здатність до абстрактного мислення, аналізу та синтезу.
GC 4	Здатність працювати в міжнародному контексті
GC 5	Здатність враховувати соціальні та економічні аспекти під час вирішення наукових та технологічних задач
<b>Special competencies (SC)</b>	
SC 1	Ability to automate complex technological objects and complexes, create cyber-physical systems based on intelligent control methods and digital technologies using databases, knowledge bases, artificial intelligence methods, robotic and intelligent mechatronic devices.
SC 2	Ability to design and implement highly reliable automation systems and their application software to implement management and information processing functions, to protect intellectual property rights for new design and engineering solutions.

SC 3	Ability to apply modelling and optimization methods to study and improve the efficiency of systems and processes for managing complex technological, organizational, and technical facilities.
SC 4	Ability to analyse the production and technological systems and complexes as automation objects, determine ways and strategies of their automation and digital transformation.
SC 5	Ability to integrate knowledge from different fields, apply a systems approach and take into account non-technical aspects in solving engineering problems and conducting research.
SC 6	Ability to apply modern automatic control theory methods to develop automated control systems for technological processes and objects.
SC 7	Ability to use specialized software and digital technologies to solve complex tasks and problems for automation and computer-integrated technologies.
SC 8	Ability to develop functional, technical and information structure of computer-integrated control systems of organizational and technological complexes using network and information technologies, software and hardware control systems, industrial controllers, mechatronic components, robotic devices and human-machine interface.
SC 9	Ability to evaluate technical and software tools used in automation systems analyse their operation modes, identify the ways to improve and modernize them.
SC 10	Ability to apply problem-oriented methods of analysis, synthesis and optimization of production, automation systems, process control systems.
SC 11	Ability to study technological objects and automated control systems, analyse their operation modes using statistical methods and data analysis methods.
SC 12	Ability to apply adaptive control methods for designing automated control systems, developing their hardware and software
<b>7 – Program learning results (PR)</b>	
PR 01	Create automation systems, cyber-physical production based on intelligent control methods, databases and knowledge bases, digital and network technologies, robotic and intelligent mechatronic devices.
PR 02	Create highly reliable automation systems with a high level of software and hardware functional and information security.
PR 03	Apply specialized conceptual knowledge, including modern scientific achievements, as well as a modern problems critical understanding in the automation and computer-integrated technologies to solve complex problems in professional activity.
PR 04	Apply modern approaches and methods of modelling and optimization for research and creation of effective automation systems with complex technological and organizational-technical objects.
PR 05	Develop computer-integrated control systems for complex technological and organizational-technical objects; apply a systems approach taking into account the non-technical components of the automation objects evaluation.
PR 06	Fluent in state and foreign languages orally and in writing to discuss professional issues and results in automation and computer-integrated technologies, present the research results and innovative projects.
PR 07	Analyse production and technical systems in a particular field of activity as automation objects and determine their automation strategy and digital transformation.
PR 08	Apply the modern mathematical methods, methods of automatic control theory, reliability theory and systems analysis for automation systems research and creation with complex technological and organizational-technical objects, cyber-physical industries.

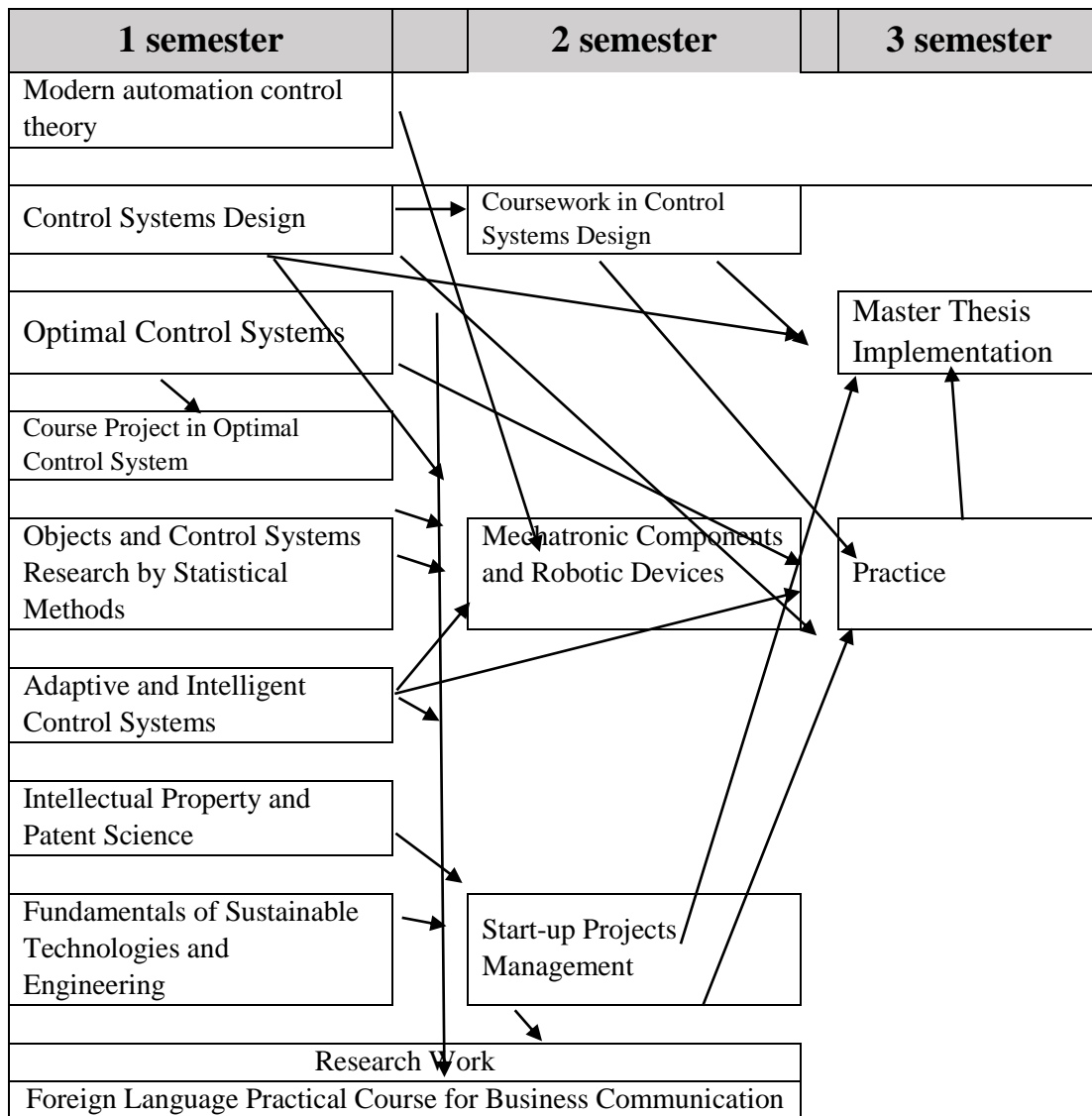


PR 09	Develop functional, organizational, technical and information automation systems structures with complex technological and organizational-technical objects, develop software and hardware control systems using network and information technologies, industrial controllers, mechatronic components, robotic devices, human-machine interface and taking into account technological conditions and requirements for production management.
PR 10	Develop and use specialized software and digital technologies to create automation systems for complex organizational and technical objects, use special software professionally.
PR 11	Adhere to the norms of academic integrity; know the basic intellectual property protection legal norms, commercialization of the results of research, invention and design activities.
PR 13	Design, analyse the work and improve modern intelligent and adaptive automatic control systems.
PR 14	Apply methods of analysis, synthesis and optimization of production, automation systems for production management, product life cycle and quality.
PR 15	Evaluate social and economic aspects of scientific and technical activities.
<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.
Information and methodical support	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 distance-learning 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	Foreign students study the Ukrainian language before studying in the program. Along with the studying in the program, the advanced study of Ukrainian as a foreign language.

## 2. EDUCATIONAL PROGRAM LIST OF COMPONENTS

Code	Educational Components (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Distribution
1	2	3	4
<b>Compulsory educational components</b>			
<b>General training cycle</b>			
CG 1	Modern automation control theory	4	exam
CG 2	Intellectual Property and Patent Science	3	final tests
CG 3	Fundamentals of Sustainable Technologies and Engineering	2	final tests
CG 4	Foreign Language Practical Course for Business Communication	4,5	final tests
CG 5	Start-up Projects Management	3	final tests
<b>Vocational training cycle</b>			
CV 1	Optimal Control Systems	4	exam
CV 2	Course Project in Optimal Control System	1,5	final tests
CV 3	Control Systems Design	3,5	final tests
CV 4	Coursework in Control Systems Design	1	final tests
CV 5	Objects and Control Systems Research by Statistical Methods	3,5	final tests
CV 6	Adaptive and Intelligent Control Systems	5	exam
CV 7	Mechatronic Components and Robotic Devices	3,5	final tests
<b>Research cycle</b>			
CV 8	Research Work	4	final tests
CV 9	Scientific and Research Practice	14	final tests
CV 10	Master Thesis Implementation	12	graduation
<b>Optional educational components</b>			
<b>Vocational training cycle</b>			
OV 1	Educational Components #1 from Faculty catalogue	5	exam
OV 2	Educational Components #2 from Faculty catalogue	5	exam
OV 3	Educational Components #3 from Faculty catalogue	5	exam
OV 4	Educational Components #4 from Faculty catalogue	4	final tests
OV 5	Educational Components #5 from Faculty catalogue	4	final tests
The total volume of the <b>compulsory educational components:</b>		<b>67</b>	
The total volume of the <b>optional educational components:</b>		<b>23</b>	
The total volume of the <b>educational components for the Educational Standard competencies</b>		<b>45</b>	
The total volume of the educational program		<b>90</b>	

### 3. EDUCATIONAL PROGRAM STRUCTURE AND LOGICAL SCHEME



### 4. FORM OF GRADUATES ASSESSMENT

According to the Standard of Higher Education, the certification for higher education applicants by the educational and professional program "Automation Hardware and Software" at specialty 151 Automation and computer-integrated technologies is carried out in the qualification work public graduation form. In successful case, the applicant issued the standard document on the taking of a master's degree with qualification in automation and computer-integrated technologies.

The qualification work should demonstrate the graduate's ability to solve complex tasks and problems of automation and computer-integrated technologies under uncertain conditions and requirements based on research and/or innovation.

The applicants qualifying work have to pass mandatory test for academic plagiarism, lack of fabrication and falsification.

The qualification work should be published in the higher education institution electronic repository and on the relevant graduating department website.

## 5. CONFORMING MATRIX BETWEEN THE PROGRAM COMPETENCIES AND THE EDUCATIONAL PROGRAM COMPONENTS

	CG1	CG2	CG3	CG4	CG5	CV1	CV2	CV3	CV4	CV5	CV6	CV7	CV8	CV9	CV10
GC 1													+	+	+
GC 2													+	+	+
GC 3													+	+	+
GC 4			+	+										+	
GC 5			+		+										+
SC 1											+	+	+		+
SC 2		+						+	+				+	+	+
SC 3	+					+	+			+			+		+
SC 4													+	+	+
SC 5													+	+	+
SC 6	+												+		+
SC 7								+	+				+	+	+
SC 8								+	+		+	+	+	+	+
SC 9													+		+
SC 10						+	+						+		+
SC 11										+			+		+
SC 12											+				+

## 6. CONFORMING MATRIX BETWEEN THE PROGRAM LEARNING RESULTS AND THE EDUCATIONAL PROGRAM COMPONENTS

	CG1	CG2	CG3	CG4	CG5	CV1	CV2	CV3	CV4	CV5	CV6	CV7	CV8	CV9	CV10
PR 01								+	+		+	+	+	+	+
PR 02								+	+		+	+	+		+
PR 03											+		+		+
PR 04						+	+			+			+		+
PR 05								+	+				+		+
PR 06				+									+	+	+
PR 07								+	+				+	+	+
PR 08	+									+			+		+
PR 09	+							+	+		+	+	+	+	+
PR 10								+	+		+		+	+	+
PR 11		+			+								+		+
PR 12													+	+	+
PR 13								+	+		+		+		+
PR 14						+	+						+		+
PR 15			+		+										+