

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 SCIENTIFIC PROGRAM

Second (master) higher education level

Speciality	151 Automation and Computer Integrated Technologies
Field of Study	15 Automation and Instrumentation Engineering
Qualification	Master of Automation and Computer Integrated Technologies

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:

Prof. Olexii Zhuchenko, Doctor of Technical Science, Associate Professor,
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 Savula, student, group LA-01mn

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:

State enterprise "Derzh CCB "Luch", Kyiv. (Signed by Deputy General Director G. Petrov);

Master's training last year students in 2020, who study in the educational and scientific 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*)

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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 – 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, 120 credits, term of study 1 year, 9 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	https://tpza.kpi.ua/ , page <i>Educational programs</i> https://osvita.kpi.ua/ , page <i>Educational programs</i>
2 – Educational program purpose	
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.	

2 – Educational program characteristics	
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 scientific
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>

4 – Graduates suitability for employment and further study	
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"> – 62.01. Computer programming; – 62.03. Computer equipment management activities; – 62.09. Other activities in information technology and computer systems <p><i>Professional qualification</i> (according to the Professions Classifier DK 003:2010)</p> <ul style="list-style-type: none"> – 2131.2. Automated Control Production Systems Engineer; – 2131.2. Computer Software Engineer; – 2131.2 Computer Systems and Automation Research Engineer; – 2139.2. Computer Application Engineer; – 2145.2. Production Processes Mechanization and Automation Engineer – 2149.1 Researcher (engineering);
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>
5 – Teaching and assessment	
Teaching and learning	Task-oriented approach. Teaching is carried out in the form of lectures, seminars, practical classes, laboratory classes in small groups (up to 12 people), self-study work with the professor’s consultation, individual lessons, using the information and communication technologies for same educational components.
Assessment	Current and semester control in the laboratory reports, presentations, and essays form, written and oral exams. Rating system.
6 – Program competencies	
Total competence	Ability to solve complex problems and problems in the automation and computer-integrated technologies field, in study and profession activity which involves research of processes, equipment and/or innovation in this field that characterized by uncertainty conditions and requirements.
General competencies (GC)	
GC 1	Ability to conduct research at the appropriate level.
GC 2	Ability to generate new ideas (creativity).
GC 3	Ability to abstract thinking, analysis and synthesis.
GC 4	Ability to work in an international context
GC 5	Ability to take into account the social and economic aspects of solving scientific and technological problems
Special competencies (SC)	
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 apply modern technologies of scientific research in processes, equipment, means, automation systems, control, diagnostics, testing and management of complex organizational and technical objects and systems.
SC 10	Ability to identify the problems scientific nature in the professional sphere, to plan and carry out relevant scientific and applied research.
SC 11	Ability to apply problem-oriented methods of analysis, synthesis and optimization of automation systems, cyber-physical industries, technological complexes control processes.
SC 12	Ability to present the research activities results, prepare scientific publications, taking part in scientific discussions at scientific conferences, symposia and carry out pedagogical activities in educational institutions.
SC 13	Ability to study technological objects and automated control systems, analyse their operation modes using statistical methods and data analysis methods.
SC 14	Ability to evaluate technical and software tools used in automation systems analyse their operation modes, identify the ways to improve and modernize them.
SC 15	Ability to apply adaptive and robust control methods for designing automated control systems, developing their hardware and software
7 – Program learning results (PR)	
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 12	Gather the necessary information using scientific and technical literature, databases and other sources, analyze and evaluate it.
PR 13	Apply modern research technologies, specialized mathematical tools for automation objects research, modelling and identification.
PR 14	Identify the problems scientific nature in the professional sphere, find ways to solve them.
PR 15	Apply methods of analysis, synthesis and optimization of cyber-physical production, automation systems for production management, product life cycle and quality.
PR 16	Plan and perform scientific and applied research in automation and computer-integrated technologies, choose effective research methods, argue conclusions, present research results.
PR 17	Develop and teach specialized disciplines in higher education institutions.
PR 18	Possess research approaches, methods and technologies in automation and computer-integrated technologies
PR 19	Design, analyse the work and improve modern intelligent, adaptive and robust automatic control systems.
PR 20	Evaluate social and economic aspects of scientific and technical activities
8 – Resource support for program implementation	
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.

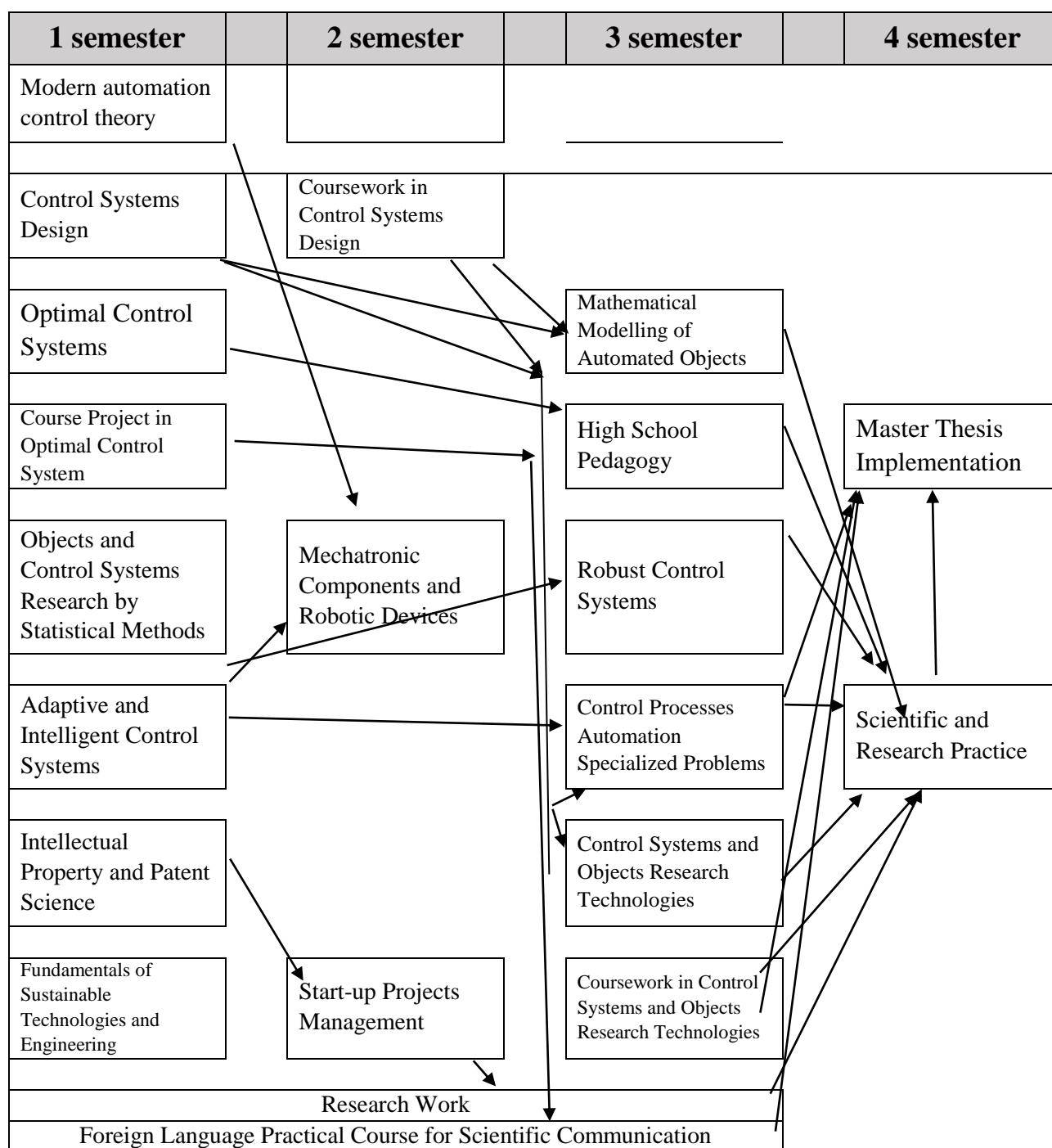
9 – Academic mobility	
National mobility	Possibility of concluding agreements on academic mobility according to the current higher education legislation of Ukraine.
International mobility	Academic mobility program Erasmus +, opportunity to participate in of the university's academic mobility programs 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
Compulsory educational components			
General training cycle			
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 Scientific Communication	4,5	final tests
CG 5	Start-up Projects Management	3	final tests
CG 6	High School Pedagogy	2	final tests
Vocational training cycle			
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
CV 8	Robust Control Systems	4	exam
CV 9	Control Processes Automation Specialized Problems	4	exam
CV 10	Mathematical Modelling of Automated Objects	3,5	final tests
Research cycle			
CV 11	Control Systems and Objects Research Technologies	3,5	final tests
CV 12	Coursework in Control Systems and Objects Research Technologies	1	final tests
CV 13	Research Work	7,5	final tests
CV 14	Scientific and Research Practice	9	final tests
CV 15	Master Thesis Implementation	17	graduation
Optional educational components			
Vocational training cycle			
OV 1	Educational Components #1 from Faculty catalogue	5	exam
OV 2	Educational Components #2 from Faculty catalogue	5	exam

1	2	3	4
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
OV 7	Educational Components #6 from Faculty catalogue	7	exam
The total volume of the compulsory educational components:		90	
The total volume of the optional educational components:		30	
The total volume of the educational components for the Educational Standard competencies		60	
The total volume of the educational program		120	

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 scientific 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

	CG 1	CG 2	CG 3	CG 4	CG 5	CG 6	CV 1	CV 2	CV 3	CV 4	CV 5	CV 6	CV 7	CV 8	CV 9	CV 10	CV 11	CV 12	CV 13	CV 14	CV 15	
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				+		+														+		+
SC 13											+				+					+		+
SC 14															+		+	+	+			+
SC 15												+		+						+		+

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

	CG 1	CG 2	CG 3	CG 4	CG 5	CG 6	CV 1	CV 2	CV 3	CV 4	CV 5	CV 6	CV 7	CV 8	CV 9	CV 10	CV 11	CV 12	CV 13	CV 14	CV 15
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							+	+								+			+	+	+
PR 16																	+	+	+	+	+
PR 17						+															
PR 18																	+	+	+	+	+
PR 19									+	+		+		+					+		+
PR 20			+		+														+		