

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

first (bachelor) higher education level

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

Enacted from 2021/2022 academic year
by order of the Rector of KPI. I. Sikorsky,
form April 04, 2021p. № NON/89/2021

PREAMBLE

DEVELOPED project group:

Project team Chairman:

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

Project team members:

Prof. Anatolii Zhuchenko, Doctor of Technical Science, Professor, Head 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

Elizabeth Melanich, student, group LA-71

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. 6 dated Desrmbber 22, 2020)

Methodological Council of Igor Sikorsky Kyiv Polytechnic Institute

Methodological Council Chairman

Prof. Yuriy YAKYMENKO

(Protocol No. 6 dated February 2, 2021)

CONSIDERED:

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

Limited Liability Company "Ventktrol", Kyiv. (signed by Director O. Demchenko);

Bachelor'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. 7 dated December 16, 2020*)

CONTENT

1. Educational program profile.....	5
2. Educational program list of components.....	10
3. Educational program structure and logical scheme.....	12
4. Form of graduates assessment.....	14
5. Conforming matrix between the program competencies and the educational program components	15
6. Conforming matrix between the program learning results and the educational program components	16

1. EDUCATIONAL PROGRAM PROFILE

Specialty 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 – Bachelor Qualification – Bachelor of Automation and Computer Integrated Technologies
Educational program official name	Automation Hardware and Software
Levels	NRC of Ukraine – level 6, QF-EHEA – first cycle, EQF-LLL – level 6.
Diploma type and educational program scope	Bachelor 's degree, single, 240 credits, term of study 3 year, 10 months
Availability of accreditation	Accreditation certificate ND-IV № 1158057, issued by the Ministry of Education and Science of Ukraine on May 30, 2013 (<i>dated June 04, 2013, 2070-L</i>), valid until July 1, 2023.
Prerequisites	Complete secondary education
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 bachelor's degree in automation and computer-integrated technologies capable of solving the tasks of designing, improving, implementing, launching and operating computer-integrated automation systems of technological processes and industries of various industries with the use of modern software and hardware.	

3 – Educational program characteristics	
Subject area	<p><i>The study and activity objects</i> of bachelor 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 of solving problems in the field of automation and computer-integrated technologies, which involves the application of existing and participating in the creation of new knowledge and / or professional practices.</p> <p><i>Theoretical content of the subject area:</i> Concepts and methodologies for synthesis, design, operation of objects and automation systems based on methods and principles of system analysis, modern technical and software, modern theory of automatic control, mathematical modelling and optimization, methods of artificial intelligence.</p> <p><i>Methods, techniques and technologies.</i> Modern methods of theoretical and experimental studies, synthesis, design, adjustment of automation and computer-integrated technologies.</p> <p><i>Tools and equipment.</i> Computer and Information Technologies, Microprocessors, Specialized Software, Designing, Development and Operation of Automation Systems, Software and Technical 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 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>Ability to study individual courses in English.</p> <p>The implementation of the program involves involving classes and advisory professional practitioners, industry experts.</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. Junior automated Control Production Systems Engineer; – 2131.2. Junior computer Software Engineer; – 2131.2 Junior computer Systems and Automation Research Engineer; – 2139.2. Junior computer Application Engineer; – 2145.2. Junior production Processes Mechanization and Automation Engineer – 3114. Technician of configured computer system – 3121. Technician programmer.

Further study	Further education according to the master degree at the second educational and scientific higher education level.
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 16 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
GC 6	The ability to make safe activities
GC 7	The desire to preserve the environment
GC 8	Ability to work in a team.
GC 9	The ability to realize their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, rule of law, human rights and freedoms and citizens in Ukraine
GC 10	Ability to store and multiply moral, cultural, scientific values and achievements of society based on the understanding of history and laws of development of the subject area, its place in the general system of knowledge about nature and society and development of society, technology and technology, use different types and forms of motor activity for Active recreation and maintenance of a healthy lifestyle
Special competencies (SC)	
SC 11	Ability to apply mathematics knowledge in the extent necessary for the use of mathematical methods for analysis and synthesis of automation systems.
SC 12	Ability to apply knowledge of physics, electrical engineering, electronics and microprocessor technology, in the extent necessary to understand processes in automation systems and computer-integrated technologies.
SC 13	Ability to analyze automation objects based on knowledge of processes that they occur and apply methods for automatic control for research, analysis and synthesis of automatic control systems.
SC 14	Ability to apply methods of system analysis, mathematical modelling, identification and numerical methods for the development of mathematical models of individual elements and automation systems as a whole, to analyze the quality of their functioning using the latest computer technologies
SC 15	The ability to substantiate the choice of technical means of automation on the basis of understanding the principles of their work analysis of their properties, appointment and technical characteristics, taking into account the requirements for the system of automation and operating conditions; Set up technical automation and control systems

SC 16	The ability to use the latest technology in automation and computer-integrated technologies, in particular, design multi-level control systems, data collection and archiving to form a database of process parameters and them visualization with the help of a person-machine interface
SC 17	The ability to justify the choice of technical structure and be able to develop application software for microprocessor control systems based on local automation tools, industrial controllers.
SC 18	The ability to design automation systems taking into account the requirements of the relevant legal documents and international standards
SC 19	Ability to use modern computer and information technologies to solve professional tasks, program and use applied and specialized computer-integrated environments to solve automation tasks.
SC 20	Ability to take into account social, environmental, ethical, economic aspects, labour protection requirements, industrial sanitation and fire safety during the formation of technical solutions.
SC 21	Taking into account commercial and economic context in the design of automation systems
SC 22	The ability to analyze the object of research and identify its properties using knowledge of fundamental engineering disciplines: physics, chemistry, engineering graphics.
SC 23	The ability to apply modern technology of designing and developing information systems and software of computer-integrated systems.
SC 24	The ability to measure a wide range of technological parameters of automation objects, perform the processing of measurement results based on methods of mathematical statistics and data analysis.
SC 25	Ability to absorb and use information from professional foreign publications in a specialty, present their own results and discuss professional issues in a foreign language.
7 – Program learning results (PR)	
PR 01	Know linear and vector algebra, differential and integral calculus, functions of many variables, functional rows, differential equations for the function of one and many variables, operational calculations, the theory of the integrated variable, theory of probabilities and mathematical statistics, the theory of random processes in the extent necessary for use mathematical apparatus and automation methods.
PR 02	Know physics, electrical engineering, electronics and circuitry, microprocessor technology at the level necessary for solving typical problems and automation problems.
PR 03	Be able to apply modern information technologies and have skills to develop algorithms and computers using high-level languages and object-oriented programming technologies, create databases and use Internet resources.
PR 04	Understand the processes essence occurring in automation objects and analyze automation objects and to substantiate the choice of structure, algorithms and control schemes based on the results of the study of their properties.
PR 05	Be able to apply automatic control theory methods for research, analysis and synthesis of automatic control systems.

PR 06	Be able to apply system analysis, modelling, identification and numerical methods for counting mathematical and simulation models of individual elements and automation systems as a whole, for analysing the quality of their functioning using the latest computer technologies.
PR 07	Be able to apply knowledge about basic principles and methods for measuring physical quantities and basic technological parameters to substantiate the choice of means `measurements and evaluation of their metrological characteristics.
PR 08	Know the principles of technical means automation operation and be able to substantiate their choice based on the analysis of their properties, purpose and technical characteristics, taking into account the requirements for automation and operational conditions; have skills for adjusting technical means of automation and control systems.
PR 09	Be able to design multi-level data management systems and data collection to form the process parameters and visualization of the means of a human-machine interface using the latest computer-integrated technologies.
PR 10	Be able to justify the choice of structure and develop application software for microprocessor control systems based on local automation tools, industrial logical controllers and programmable logic matrices and signal processors.
PR 11	Be able to perform work on 'design automation systems, know the content and rules for designing design materials, design documentation and sequence of project work, taking into account the requirements of relevant legal documents and international standards.
PR 12	Be able to use a variety of specialized software for solving typical engineering tasks in automation, in particular mathematical modelling, automated design, data management, computer graphics methods.
PR 13	Be able to take into account social, environmental, ethical, economic aspects, labour protection requirements, industrial sanitation and fire safety during the formation of technical solutions. Be able to use different types and forms of motor activity for active recreation and healthy lifestyle.
PR 14	Be able to use fundamental concepts and categories of state building to justify their own ideological positions and political beliefs taking into account the processes of socio-political history of Ukraine, legal principles and ethical norms.
PR 15	Be able to use knowledge of fundamental disciplines of engineering training in professional activity
PR 16	Know modern design technology and development of information systems and be able to apply these technologies.
PR 17	Know the nomenclature, principles of action and scope of control and measuring instruments and be able to carry out technological measurements, handle and interpret their results.
PR 18	Know specialized foreign terminology and be able to conduct a discussion in a professional realm in a foreign language.
8 – Resource support for program implementation	
Staffing	In accordance with personnel requirements for providing educational activities for an appropriate level of higher education approved Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015, №1187, valid in the editorial office, <i>May 23, 2018</i> , № 347

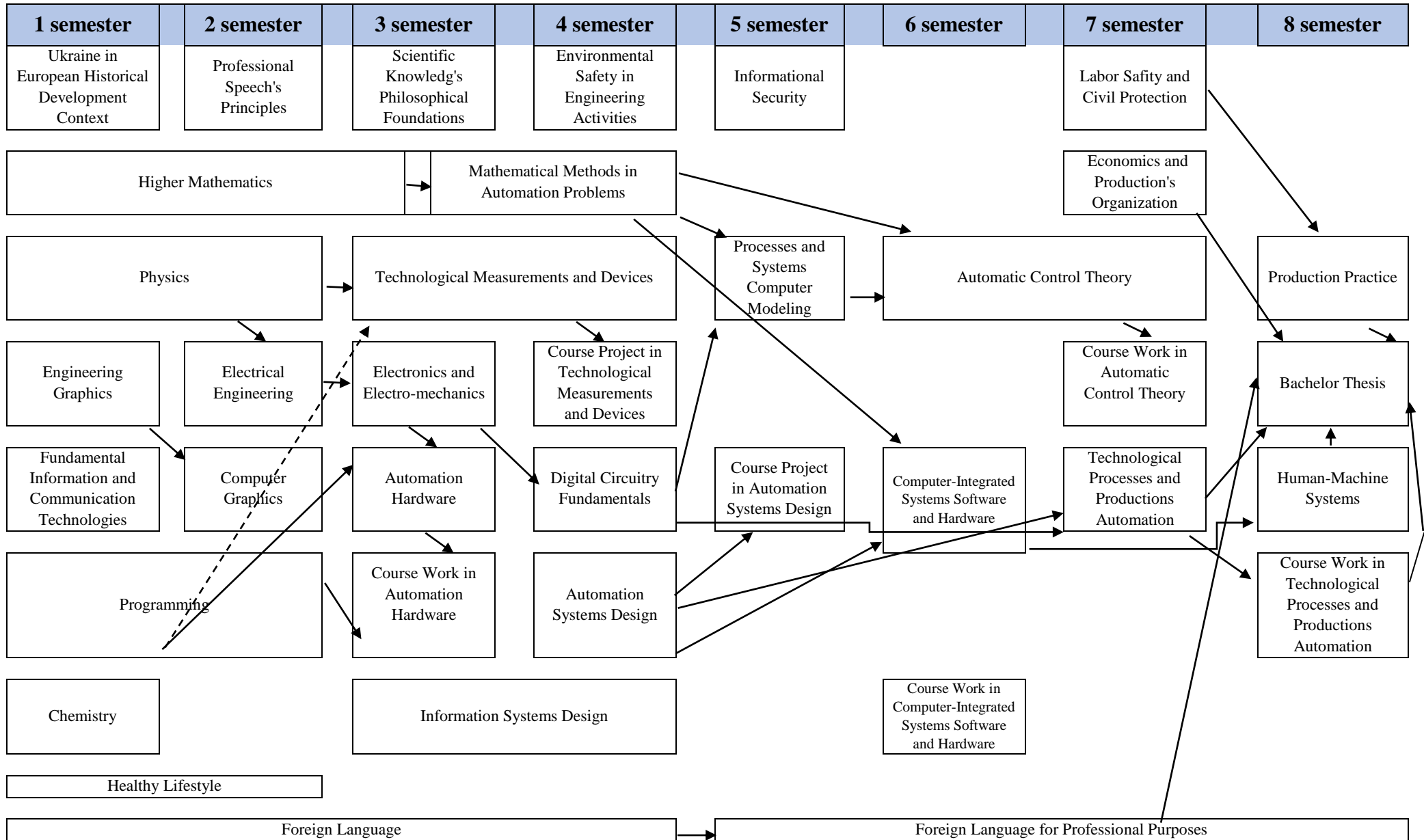
Logistics	In accordance with personnel requirements for providing educational activities for an appropriate level of higher education approved Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015, №1187, valid in the editorial office, <i>May 23, 2018</i> , № 347
Information and teaching and methodological support	In accordance with personnel requirements for providing educational activities for an appropriate level of higher education approved Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015, №1187, valid in the editorial office, <i>May 23, 2018</i> , № 347 Use of library funds, e-repository, university distance learning platform.
9 – Academic mobility	
National Mobility	Credit Ability to conclude academic mobility agreements in accordance with the current legislation of Ukraine in the field of highest world.
International Mobility	Credit Academic Mobility Program ERASMUS+CA1, Participation in the University's Academic Mobility programs at a competitive principles.
Training of foreign curriculums of higher education	Foreign students study the Ukrainian language before passing the program. In the further study Ukrainian language, as a foreign, deepen.

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	Ukraine in European Historical Development Context	2	final tests
CG 2	Chemistry	3	final tests
CG 3	Engineering Graphics	3	final tests
CG 4	Physics	10	exam
CG 5	Higher Mathematics	18	exam
CG 6	Professional Speech's Principles	2	final tests
CG 7	Healthy Lifestyle	3	final tests
CG 8	Foreign Language	6	final tests
CG 9	Scientific Knowledge's Philosophical Foundations	2	final tests
CG 10	Environmental Safety in Engineering Activities	2	final tests
CG 11	Informational Security	2	final tests
CG 12	Foreign Language for Professional Purposes	6	exam
CG 13	Economics and Production's Organization	4	final tests
CG 14	Labour Safety and Civil Protection	4	final tests
Vocational training cycle			
CV 1	Fundamental Information and Communication Technologies	3	final tests
CV 2	Programming	10	exam
CV 3	Electrical Engineering	4	final tests
CV 4	Computer Graphics	4	final tests
CV 5	Electronics and Electro-mechanics	4	final tests
CV 6	Automation Hardware	5	exam
CV 7	Course Work in Automation Hardware	1	final tests

1	2	3	4
CV 8	Information Systems Design	6,5	final tests
CV 9	Technological Measurements and Devices	8	exam
CV 10	Course Project in Technological Measurements and Devices	1,5	final tests
CV 11	Digital Circuitry Fundamentals	5	exam
CV 12	Mathematical Methods in Automation Problems	9	exam
CV 13	Processes and Systems Computer Modelling	5	exam
CV 14	Automation Systems Design	4	final tests
CV 15	Course Project in Automation Systems Design	1,5	final tests
CV 16	Computer-Integrated Systems Software and Hardware	6,5	exam
CV 17	Course Work in Computer-Integrated Systems Software and Hardware	1	final tests
CV 18	Automatic Control Theory	10	exam
CV 19	Course Work in Automatic Control Theory	1	final tests
CV 20	Technological Processes and Productions Automation	6,5	exam
PO 21	Course Work in Technological Processes and Productions Automation	1	final tests
CV 22	Human-Machine Systems	3,5	exam
CV 23	Production Practice	6	final tests
CV 24	Bachelor Thesis	6	graduation
Optional educational components			
General training cycle			
ZV 1	Educational Components #1 from University catalogue	2	final tests
ZV 2	Educational Components #2 from University catalogue	2	final tests
Vocational training cycle			
PV 1	Educational Components #1 from Faculty catalogue	4	final tests
PV 2	Educational Components #2 from Faculty catalogue	4	final tests
PV 3	Educational Components #3 from Faculty catalogue	4	final tests
PV 4	Educational Components #4 from Faculty catalogue	4	final tests
PV 5	Educational Components #5 from Faculty catalogue	4	final tests
PV 6	Educational Components #6 from Faculty catalogue	4	final tests
PV 7	Educational Components #7 from Faculty catalogue	4	final tests
PV 8	Educational Components #8 from Faculty catalogue	4	final tests
PV 9	Educational Components #9 from Faculty catalogue	4	final tests
PV 10	Educational Components #10 from Faculty catalogue	4	final tests
PV 11	Educational Components #11 from Faculty catalogue	4	final tests
PV 12	Educational Components #12 from Faculty catalogue	4	final tests
PV 13	Educational Components #13 from Faculty catalogue	4	final tests
PV 14	Educational Components #14 from Faculty catalogue	4	final tests
The total volume of the compulsory educational components:		180	
The total volume of the optional educational components:		60	
The total volume of the educational components for the Educational Standard competencies		120	
The total volume of the educational program		240	

3. EDUCATIONAL PROGRAM STRUCTURE AND LOGICAL SCHEME



4. FORM OF GRADUATES ASSESSMENT

The certification of higher education for the educational and professional program "Automation hardware and software" is carried out in the form of qualification work public graduation which ends with the issuance of established sample document with bachelor's degree of Automation and Computer Integrated Technologies.

Qualification work involves solving a complex specialized task or practical problem, with the use of theories and methods of specialty characterized by the complexity and uncertainty of conditions, during professional automation activity.

Qualification work should not contain academic plagiarism, falsification. The qualification work should be published on the site of the institute. Work must meet other requirements established by national law.

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

	CG01	CG02	CG03	CG04	CG05	CG06	CG07	CG08	CG09	CG10	CG11	CG12	CG13	CG14	CV01	CV02	CV03	CV04	CV05	CV06	CV07	CV08	CV09	CV10	CV11	CV12	CV13	CV14	CV15	CV16	CV17	CV18	CV19	CV20	CV21	CV22	CV23	CV24				
GC 1																					+			+								+		+		+	+					
GC 2						+																																				
GC 3								+				+																														
GC 4															+			+																				+				
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GC 25												+																													+	

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

	CG 01	CG 02	CG 03	CG 04	CG 05	CG 06	CG 07	CG 08	CG 09	CG 10	CG 11	CG 12	CG 13	CG 14	CV 01	CV 02	CV 03	CV 04	CV 05	CV 06	CV 07	CV 08	CV 09	CV 10	CV 11	CV 12	CV 13	CV 14	CV 15	CV 16	CV 17	CV 18	CV 19	CV 20	CV 21	CV 22	CV 23	CV 24			
PR 01					+																					+															
PR 02				+													+		+							+															
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