MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
" IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE "

APPROVED

Academic Council of Igor Sikorsky Kyiv Polytechnic Institute

(№ ___from "__" _____2020)

Chairman of the Academic Council

_____ *Mykhailo ILCHENKO*

COMPUTER-INTEGRATED TECHNOLOGIES AND NAVIGATION AND CONTROL SYSTEMS

(Computer-Integrated Technologies and Navigation and Control Systems)

EDUCATIONAL PROFESSIONAL PROGRAM

second (master's) level of higher education

specialty	**151 Automation and computer-integrated technologies**
field of knowledge	**15 Automation and instrumentation**
qualification	**Master of Automation and Computer Integrated Technologies**

Put into effect by order of the rector
of Igor Sikorsky Kyiv Polytechnic Institute
from _____ 2020 № ____

Igor Sikorsky Kyiv Polytechnic Institute
Kyiv - 2020

PREAMBLE

DEVELOPED by the project team:

Project team leader

Avrutov Vadym Viktorovych, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Instruments and Systems of Orientation and Navigation

Project team members:

Burau Nadiya Ivanivna, Doctor of Technical Sciences, Professor, Head of the Department of Instruments and Systems of Orientation and Navigation

Pavlovsky Oleksiy Mykhailovych, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Orientation and Navigation Devices and Systems

Golovach Serhiy Volodymyrovych, Candidate of Technical Sciences, Chief Specialist in the direction of JSC Elmiz

Platov Ilya Mikhailovich, student of group PG-01mn of the department of devices and systems of orientation and navigation

Head of the Department of Instruments and Orientation and Navigation Systems

Burau Nadiya Ivanivna, Doctor of Technical Sciences, Professor _____

AGREED:

Scientific and methodical commission of KPI named after Igor Sikorsky, majoring in 151 Automation and computer-integrated technologies

Chairman of the NMCU _____ Anatoliy ZHUCHENKO

(Minutes № ___ of ___ _____ 2020)

Methodical council of KPI named after Igor Sikorsky

Chairman of the Methodical Council _____ Yuriy YAKYMENKO

(Minutes № ___ of ___ _____ 2020)

INCLUDED:

In connection with the approval of the Standard of Higher Education in the specialty 151 151 Automation and computer-integrated technologies for the second (master's) level of higher education by the order of the Ministry of Education and Science of Ukraine dated 10.08.2020 №1022, the educational program was monitored.

According to the results of monitoring the educational program "Computer-integrated technologies and navigation and control systems" of the second (master's) level of higher education, approved by the Academic Council on 02.04.2018, protocol №4, taking into account the proposals of participants and graduates and stakeholders, it was modernized.

The project team reviewed the balance, rational use of loans, the ability of students to master certain disciplines (educational components) and the entire educational program, investing in a certain time, the completeness of documentary, personnel, information and other support OP and compliance of the educational program.

To ensure the possibility of forming an individual educational trajectory, including due to the individual choice of academic disciplines in the amount provided by law, and in order to ensure compliance with the Standard of Higher Education, it was decided to replace the existing sample units with separate educational components.

OP was discussed and approved at the meeting of the Department of Instruments and Systems of Orientation and Navigation (№ 1 from «02» September 2020).

CONTENT

1. PROFILE OF THE EDUCATIONAL PROGRAM

in specialty 151 "Automation and computer-integrated technologies"

1 - General information	
Full name of ZVO and institute / faculty	National Technical University of Ukraine, *Igor Sikorsky Kyiv Polytechnic Institute*, Faculty of Instrument-Making
Higher education degree and title of qualification in the original language	Degree - Master Educational qualification - Master of Automation and Computer-Integrated Technologies
Program cycle / level	NRC of Ukraine - level 8, QF-EHEA - second cycle, EQF-LLL - level 7
The official name of the educational program	Computer-integrated technologies and navigation and control systems
Type of diploma and scope of educational program	Master's degree, single, 90 credits, term of study 1 year, 4 months
Availability of accreditation	Certificate of accreditation ND № 1192621 dated 25.09.2017 issued in accordance with the decision of the Accreditation Commission dated 27.06.2013 (order of the Ministry of Education and Science of Ukraine dated 01.07.2013) in the field of knowledge 15 Automation and instrumentation, specialty 151 Automation and computer integrated technologies. The certificate is valid until July 1, 2023.
Prerequisites	Having a bachelor's 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	*https://osvita.kpi.ua/ section "Educational programs"* *http://kafpson.kpi.ua/metot.html* *https://pbf.kpi.ua/ua/category/documents/*
2 - The purpose of the educational program	
Training of specialists capable of complex solution of complex tasks and problems of creation, improvement, modernization, operation and maintenance of automation, control, orientation and navigation, monitoring systems, their components, cyberphysical systems, digital transformation technologies, behind the tasks of Industry 4.0, contribute to the process of rapid adaptation of products and services of enterprises and companies, as well as ensure the transition from the physical to the digital world. They operate on the basis of the concept of sustainable development of society and ensuring a worthy place of Ukraine in the world community.	

3 - Characteristics of the educational program	
Subject area (field of knowledge, specialty)	**Objects of study** and activities of masters in automation and computer-integrated technologies are: objects and processes of management (technological processes, production, organizational structures), technical, informational, mathematical, software and organizational support of automation systems in various fields. *Learning objectives*: training of engineers and scientists capable of complex solutions to complex problems and problems of creation, improvement, modernization, operation and maintenance of automation systems, their components, cyberphysical systems, digital transformation technologies behind the tasks of Industry 4.0, contribute to the process of rapid product adaptation and services of enterprises and companies, as well as provide a transition from the physical to the digital world. *Theoretical content of the subject area:* concepts and principles of the theory of automatic control, principles of development of automation systems and computer-integrated technologies. *Methods, techniques and technologies.*Methods of analysis, synthesis, design, commissioning, modernization, operation and maintenance of automation systems and computer-integrated technologies, cyberphysical industries; methodology of scientific research of control objects and automation systems of complex organizational and technical objects. *Tools and equipment.* Digital and network technologies, microprocessors, programmable logic controllers (PLC), embedded digital devices and systems (Embedded Systems), intelligent mechatronic and WLAN-compatible components of Internet of Things technology (IoT), specialized software for design, development and operation of automation systems.
Orientation of the educational program	Educational and professional.
The main focus of the educational program	Special education and training in the field of automation and computer-integrated technologies, navigation and control systems, cyberphysical systems, Industry 4.0 technologies with the possibility of acquiring the necessary professional competencies for further professional activity. Keywords: automation, orientation and navigation systems, control systems, monitoring systems, computer-integrated technologies and systems, cyberphysical systems, instrument making
Features of the program	Implementation of the program provides an opportunity to involve professionals, industry experts, representatives of employers and stakeholders in the fields of automation and computer-integrated technologies, navigation and control systems, which is directly related to the focus of the educational program.
4 - Suitability of graduates for employment and further study	
Suitability for employment	Positions according to the classifier of professions of Ukraine. According to the Classifier of Professions DK 003: 2010 Master's degree in 151 Automation and computer-integrated technologies must be prepared for the following positions: 2131.2 Research Engineer in Computer Systems and Automation 2131.2 Engineer of automated production control systems 2145.2 Engineer for mechanization and automation of production processes

Further training	Continuation of education according to the program of preparation of the doctor of philosophy at the third educational and scientific level of higher education. Lifelong learning for development and self-improvement in professional and scientific fields, as well as in other related fields of knowledge
5 - Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of blended learning, practice and excursions; performance of qualification work
Evaluation	Written and oral examinations, laboratory reports, current control, defense of course projects, oral presentations, defense of qualification work
6 - Program competencies	
Integral competence	Ability to solve complex problems and problems of automation, navigation and control systems, computer-integrated technologies in professional activities and / or in the learning process, which involves research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements
General Competences (LC)	
ZK 1	Ability to conduct research at the appropriate level
ZK 2	Ability to generate new ideas (creativity)
ZK 3	Ability to abstract thinking, analysis and synthesis
ZK 4	Ability to work in an international context
Professional competencies of the specialty (FC)	
FC 1	Ability to automate complex technological objects and complexes, to create cyberphysical systems based on intelligent control methods and digital technologies using databases, knowledge bases, artificial intelligence methods, robotic and intelligent mechatronic devices
FC 2	Ability to design and implement highly reliable automation systems and their application software, to implement the functions of management and information processing, to protect intellectual property rights to new design and engineering solutions
FC 3	Ability to apply modeling and optimization methods to study and increase the efficiency of systems and processes for managing complex technological and organizational and technical facilities
FC 4	Ability to analyze production and technological systems and complexes as objects of automation, to determine methods and strategies of their automation and digital transformation
FC 5	Ability to integrate knowledge from other fields, apply a systems approach and take into account non-technical aspects in solving engineering problems and conducting research
FC 6	Ability to apply modern methods of automatic control theory for the development of automated control systems for technological processes and objects
FC 7	Ability to use specialized software and digital technologies to solve complex problems and problems of automation and computer-integrated technologies
FC 8	Ability to develop functional, technical and information structure of computer-integrated control systems of organizational and technological complexes with the use of network and information technologies, software and hardware control systems, industrial controllers, mechatronic components, robotic devices and human-machine interface
FC 9	Ability to theoretically calculate and model sensitive elements for systems of orientation, navigation and control, to apply methods of integrated and autonomous positioning and to determine navigation parameters of fixed and moving objects.

FC 10	Ability to apply modern algorithms for determining the parameters of orientation and navigation, elements of artificial intelligence and robotics, microelectromechanical devices and systems, microcontrollers and microsystem technology for the development of modern orientation and navigation, control and monitoring systems.
FC 11	The ability to apply modern methodological, instrumental and algorithmic means of improving accuracy orientation, navigation and control systems, their sensing elements and inertial measuring modules for stationary and moving objects.
7 - Program learning outcomes	
PRN 1	Create automation systems, cyberphysical production based on the use of intelligent control methods, databases and knowledge bases, digital and network technologies, robotic and intelligent mechatronic devices.
PRN 2	Create highly reliable automation systems with a high level of functional and information security of software and hardware.
PRN 3	Apply specialized conceptual knowledge, including modern scientific achievements, as well as critical understanding of modern problems in the field of automation and computer-integrated technologies to solve complex problems of professional activity
PRN 4	Apply modern approaches and methods of modeling and optimization for research and creation of effective automation systems with complex technological and organizational-technical objects.
PRN 5	Develop computer-integrated control systems for complex technological and organizational-technical objects, applying a systematic approach taking into account the non-technical components of the evaluation of automation objects.
PRN 6	Fluently communicate in state and foreign languages orally and in writing to discuss professional problems and results in the field of automation and computer-integrated technologies, presentation of research results and innovative projects
PRN 7	Analyze production and technical systems in a particular field of activity as objects of automation and determine the strategy of their automation and digital transformation.
PRN 8	Apply modern mathematical methods, methods of automatic control theory, reliability theory and systems analysis for research and creation of automation systems with complex technological and organizational-technical objects, cyberphysical industries.
PRN 9	Develop functional, organizational, technical and information structures of automation systems 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
PRN 10	Develop and use specialized software and digital technologies to create automation systems for complex organizational and technical facilities, professionally own special software.
PRN 11	Adhere to the norms of academic integrity, know the basic legal norms for the protection of intellectual property, commercialization of the results of research, invention and design activities.
PRN 12	Collect the necessary information using scientific and technical literature, databases and other sources, analyze and evaluate it.
PRN 13	Calculate and model sensitive elements for orientation, navigation and control systems using methods of integrated and autonomous positioning and determination of navigation parameters of fixed and moving objects.

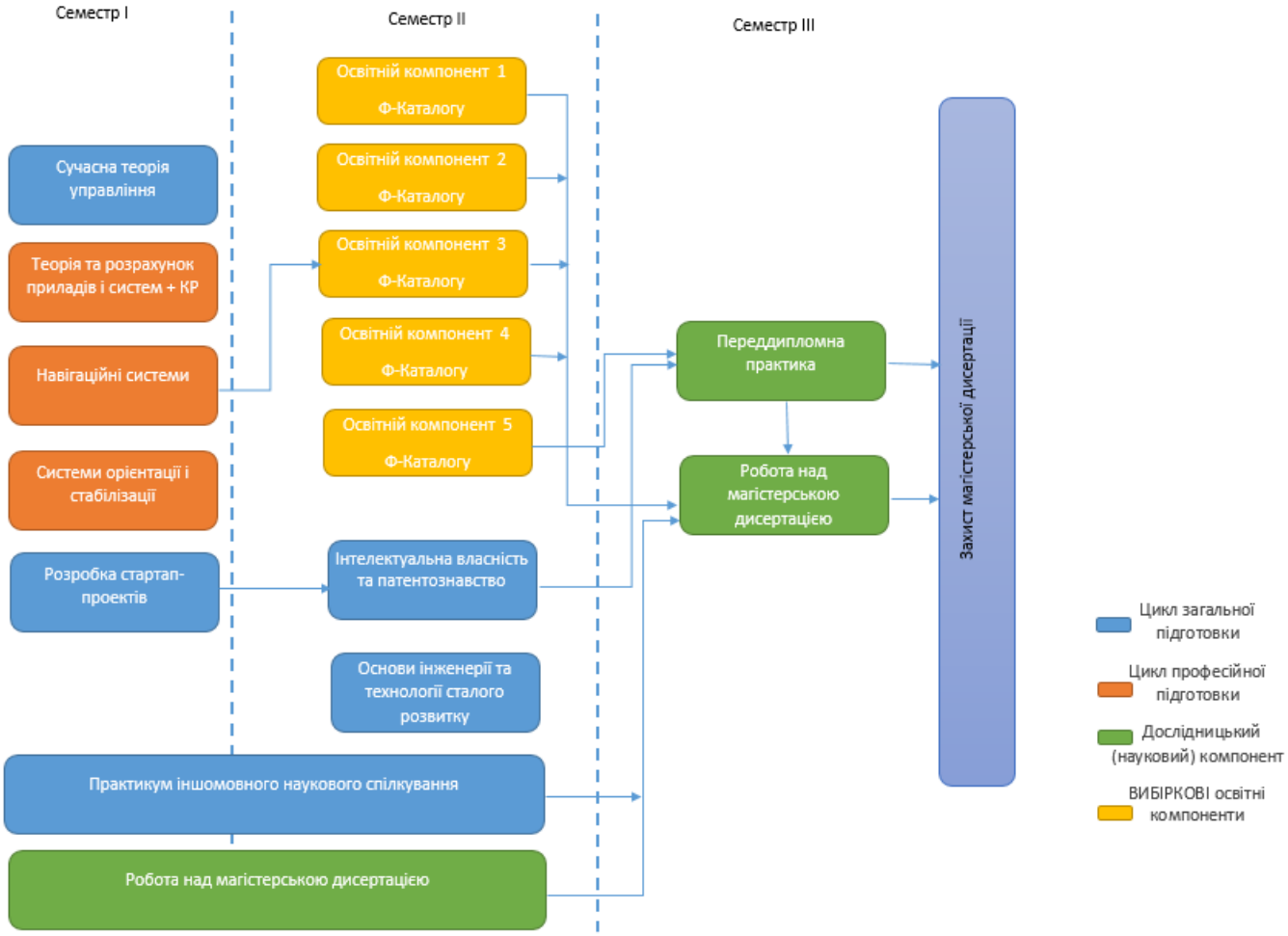
PRN 14	Develop modern systems of orientation, navigation, control and monitoring based on the use of modern algorithms for determining the parameters of orientation and navigation, elements of artificial intelligence and robotics, microelectromechanical devices and systems, microcontrollers and microsystems.
PRN 15	Apply methodical, instrumental and algorithmic means of improving accuracy orientation, navigation and control systems, their sensing elements and inertial measuring modules for stationary and moving objects.
8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements to ensure the implementation of educational activities for the appropriate level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 dated 10.05.2018, involvement of scientists and practitioners of industry institutions and enterprises
Logistics	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 dated 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform, demonstration industry equipment during laboratory workshops
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of VO (Annex 5 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 10.05.2018 Use of the Scientific and Technical Library of KPI named after Igor Sikorsky
9 - Academic mobility	
National credit mobility	Based on bilateral agreements between the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky" and technical universities of Ukraine
International credit mobility	Based on bilateral agreements between the National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky" and educational institutions of partner countries, agreements on international academic mobility, agreements on double graduation.
Training of foreign applicants for higher education	Teaching in a foreign language or after studying the Ukrainian language course by foreign applicants

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code n / a	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	Number of ECTS credits	Form of final control
1	2	3	4
1. Normative educational components of OP			

1	2	3	4
General training cycle			
ЗО 1	Modern management theory	4	exam
ЗО 2	Intellectual property and patent science	3	test
ЗО 3	Fundamentals of engineering and technology of sustainable development	2	test
ЗО 4	Workshop of foreign language business communication	3	test
ЗО 5	Development of startup projects	3	test
Cycle of professional training			
ON 1	Theory and calculation of devices and systems	7	exam
ON 2	Theory and calculation of devices and systems	1	test
ON 3	Navigation systems	6.5	test
ON 4	Orientation and stabilization systems	4	test
Research (scientific) component			
ON 5	Scientific work on the topic of master's dissertation	4	test
ON 6	Pre-diploma practice	14	test
ON 7	Work on a master's thesis	16	protection
2. Selective educational components of OP			
Cycle of professional training			
PV 1	Educational component 1 of the F-catalog	5	exam
PV 2	Educational component 2 of the F-catalog	5	test
PV 3	Educational component 3 of the F-catalog	5	test
PV 4	Educational component 4 of the F-catalog	4.5	test
PV 5	Educational component 5 of the F-catalog	3	test
The total amount of mandatory components: 67.5			
Total volume of sample components (≥25%): 22.5			
The amount of educational components that ensure the acquisition of competencies of certain SVO 71.5			
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM 90			

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF FINAL CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Graduation certification of higher education students under the educational-professional program "Computer-integrated technologies and navigation and control systems" specialty 151 Automation and computer-integrated technologies is carried out in the form of public defense of the final qualification work and ends with the issuance of a standard document Master's degree with qualification: Master of Automation and Computer-Integrated Technologies for the educational-professional program "Computer-Integrated Technologies and Navigation and Control Systems".

The final qualification work should demonstrate the graduate's ability to solve complex problems and problems in the field of automation, computer-integrated technologies, orientation systems, navigation control and monitoring based on research and / or innovation in the presence of uncertain conditions and requirements.

The applicant's qualification work is subject to mandatory testing for academic plagiarism and must be posted on the website of the higher education institution.

5. MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCES TO COMPONENTS OF THE EDUCATIONAL PROGRAM

	ЗО 1	ЗО 2	ЗО 3	ЗО 4	ЗО 5	ОН 1	ОН 2	ОН 3	ОН 4	ОН 5	ОН 6	ОН 7
	1	2	3	4	5	6	7	8	9	10	11	12
ZK 1	+									+	+	+
ZK 2		+								+	+	+
ZK 3			+							+		+
ZK 4			+	+								
FC 1	+				+							+
FC 2	+			+								+
FC3	+				+			+	+			
FC 4	+				+						+	
FC 5			+							+		+
FC 6	+							+	+			
FC 7								+	+			+
FC 8	+							+	+			+
FC 9						+	+	+	+			+
FC 10						+	+	+	+			
FC 11	+					+	+	+	+			

6. MATRIX FOR PROVIDING PROGRAM LEARNING OUTCOMES WITH RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	ЗО 1	ЗО 2	ЗО 3	ЗО 4	ЗО 5	ОН 1	ОН 2	ОН 3	ОН 4	ОН 5	ОН 6	ОН 7
	1	2	3	4	5	6	7	8	9	10	11	12
PRN 1	+				+							+
PRN 2	+											+
PRN 3			+							+	+	+
PRN 4	+							+	+			
PRN 5	+	+	+		+						+	+
PRN 6				+								
PRN 7	+									+		
PRN 8	+					+	+	+	+			
PRN 9	+							+	+			+
PRN 10	+							+	+			+
PRN 11		+								+		
PRN 12					+					+		+
PRN 13						+	+	+	+			
PRN 14	+					+	+	+	+			
PRN 15						+	+	+	+			