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
(Protocol №10 from 13.12. 2021)
Head of the Academic Council
Mykhailo ILCHENKO

Control Systems of Flight Vehicles and Complexes Engineering

EDUCATIONAL AND SCIENTIFIC PROGRAM

third level of higher education

specialty	**173 Avionics**
field of knowledge	**17 Electronics and telecommunications**
qualification	**Philosophy Doctor in Avionics**

Put into effect from 2022/2023 e.y.
by order of the Rector
Igor Sikorsky Kyiv Polytechnic Institute
from 15.02.2022 №НОН/75/2022

Kyiv – 2021

PREAMBLE

DEVELOPED by the project team:

The project team chairman

Oleksandr Zbrutskyi, Doctor of Technical Sciences, Professor, Professor of the Department of Aircraft Control Systems

The project team members:

Mykola Chernjak, Ph.D., Associate Professor, Associate Professor of the Department of Aircraft Control Systems
Vitalyi Burnashev, Ph.D., Associate Professor, Associate Professor of the Department of Aircraft Control Systems
Sergyi Ponomarenko, Ph.D., Senior Researcher, Head of the Department of Aircraft Control Systems
Oleksyi Kurganskyi, Deputy Chief Designer of Antonov State Enterprise
Lev Semenov, Ph.D., head of the ISR laboratory of NASU and SSAU
Vladislav Rybak, Deputy Director-Chief Designer of the Municipal Enterprise of Special Instrument-Building Arsenal
Maxim Sainog, Ph.D., Head of the Department of the State Kyiv Design Bureau "Luch"
Oleksyi Petrenko, Ph.D., Deputy Chairman of the Board of Elmiz Joint Stock Company
Evgenyi Skvar, Doctor of Technical Sciences, Professor, Leading Researcher of the Institute of Hydromechanics of NASU, Visiting Professor of Zhejiang Pedagogical University
Vladislav Osokin, graduate student of the Department of Aircraft Control Systems
Head of the Department of Aircraft Control Systems
Sergyi Ponomarenko, Ph.D., Senior Researcher

AGREED:

Scientific and methodical commission of Igor Sikorsky Kyiv Polytechnic Institute on specialty 173 "Avionics":

Head SMC 173 **Oleksandr ZBRUTSKYI**
(Protocol №4 from 08.12.2021)

Deputy Head of the Methodical Council **Anatolii MELNYCHENKO**
(Protocol №2 from 09.12.2021)

INCLUDED:

Reviews, suggestions and recommendations of stakeholders and experts: **Institute of Space Research NASU and SSAU, Antonov State Enterprise, Municipal Enterprise of Special Instrument-Building Arsenal, State Kyiv Design Bureau "Luch", Honored Worker of Science and Technology of Ukraine, laureate of the State Prize of Ukraine in the field of science and technology, professor of the Institute of Telecommunications Systems Igor Sikorsky KPI O. Lysenko, Leading Researcher of the Department of Hydrobionics and Boundary Layer Management of the Institute of Hydromechanics of the National Academy of Sciences of Ukraine, Visiting Professor of Zhejiang Pedagogical University (PRC), Doctor of Technical Sciences, Professor E. Shkvar** - regarding the implementation of dual education, opportunities to participate in international educational programs, expanding the focus of the educational program on robotic equipment, taking into account in accordance with the experience of leading foreign universities European and leading international standards of higher education for related specialties, active involvement of applicants , strengthening the requirements for the publication of scientific papers.

The results of self-analysis of the educational process of the Department of Aircraft Control Systems for 2021.

The update of the educational program has been agreed with the stakeholders, and the positive feedback provided on the program remains relevant.

Professional expertise was conducted by:
Director - Chief Designer SE SDB "Arsenal" M. Likholit

Director of the Institute of Space Research of NASU and SSAU O.Fedorov

The educational and scientific program was discussed after receiving all the wishes and suggestions from students and graduates and approved at a meeting of the Department of Aircraft Control Systems (protocol № 5 from 08.12.2021).

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1. PROFILE OF THE EDUCATIONAL PROGRAM

1 - General information	
Full name of HEI and institute / faculty	NATIONAL TECHNICAL UNIVERSITY OF UKRAINE «Igor Sikorsky Kyiv Polytechnic Institute», Educational and Scientific Institute of Aerospace Technology
Degree of higher education and title of qualification in the original language	Degree of HE - Doctor of Philosophy Educational qualification - Doctor of Philosophy in Avionics
The official name of the EP	Control Systems of Flight Vehicles and Complexes Engineering
Type of diploma and scope of EP	Doctor of Philosophy Diploma, Educational component 40 ECTS credits, training period 4 years The scientific component involves conducting your own research and registration of its results in the form of a dissertation
Availability of accreditation	Certificate of accreditation of the educational program №2283 from 04.10.2021, valid until 01.07.2027
Cycle / level of HE	NQF of Ukraine - level 8 QF-EHEA the third cycle EQF-LLL - level 8
Prerequisites	The presence of a master degree
Language (s) of teaching	Ukrainian / English
Validity of the EP	Until the next accreditation
Internet address of the permanent placement of the educational program	https://skla.kpi.ua/ua/study/osvitni-prohramy/ Section "Training - Educational programs" https://osvita.kpi.ua/ Section "Educational programs"
2- The purpose of the educational program	
Training of highly qualified, competitive, integrated in the European and world scientific and technical space professionals with a degree of Doctor of Philosophy in Electronics and Telecommunications, specialty 173 "Avionics", able to solve complex problems in the field of avionics, aircraft control systems and complexes of moving objects. research and innovation, organizational and managerial, pedagogical activities in the field of avionics and related fields in higher education institutions, through the internationalization of the educational process in terms of sustainable innovative scientific and technical development. Implemented through: - harmonious and multidimensional education of future highly qualified technical professionals, able to comprehensively and systematically analyze problems in avionics and related fields, realizing the nature of surrounding processes and phenomena, to provide and implement cultural communication; - formation of high adaptability of higher education seekers in the conditions of labor market transformation through interaction with employers and other stakeholders. The purpose of the educational program corresponds to the strategy of development of Igor Sikorsky Kyiv Polytechnic Institute for 2020-2025years.	
3 - Characteristics of the educational program	
Subject area	*Object of activity*: Processes and phenomena of avionics, control systems of flight vehicles and complexes engineering.

	Learning Objectives: to train avionics professionals capable of solving complex problems of professional and / or research and innovation activities in the field of avionics. *Theoretical content of the subject area*: concepts, approaches, principles of research and design of avionics systems, aircraft avionics; modern theory of automatic control; creation of hardware and software-algorithmic means to increase the accuracy, reliability, survivability of systems and avionics. *Methods, techniques and technologies*: analytical, numerical and experimental studies of avionics systems, methods and technologies of automated development of on-board aircraft avionics and aircraft control systems, information transmission, processing and display systems. *Tools and equipment*: stands and simulation software for modeling avionics systems; devices and systems of automatic control, computing means, microprocessor control systems of onboard and ground equipment.
Orientation EP	Educational and scientific
The main focus of the EP	Acquisition of in-depth knowledge in the specialty and professional training in the field of development, design, research of devices and control systems of aviation, rocket, space and robotic technologies. It is based on innovative ideas, concepts, paradigms, principles, theories in avionics and other results of modern scientific research. Keywords: control systems, avionics.
Features of EP	The program focuses on conducting research work according to the research topics of supervisors. The high level of the research part of the training is provided by the scientific school "Gyroscopes and navigation systems". The implementation of the program provides for involvement of practitioners, industry experts, representatives of employers in classroom studies.
4 - Suitability of graduates for employment and further study	
Suitability for employment	According to the National Classifier of Ukraine: Classifier of professions (SC 003: 2010), including: 2149.1 Avionics Researcher
Further training	Continuing education in doctoral studies and / or participation in postdoctoral programs
5 - Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, participation in the implementation of research projects and preparation of scientific publications, doctoral dissertation, blended learning technology and learning through research,, holding regular conferences, seminars, colloquia, access to the use of laboratories, equipment, etc.
Evaluation	Rating system of assessment, oral and written exams, tests, testing, etc., defense of a dissertation on a research topic
6 - Program competencies	
Integral competence	Ability to solve complex problems in the field of

	development and analytical-experimental research of avionics devices and systems of aircraft and complexes of moving objects, and to carry out research and innovation activities, which involves a deep rethinking of existing knowledge and the creation of new holistic knowledge and/or implementation the professional practice in the field of avionics
General Competences (GC)	
GC01	Ability to abstract thinking, analysis and synthesis.
GC02	Ability to search process and analyze information from various sources.
GC03	Ability to work in an international context.
GC04	Ability to initiate and implement research and innovation projects, manage projects, research activities of the department, organize the development of creative initiative of the team.
GC05	Ability to provide continuous self-development and self-improvement
GC06	Ability to use modern methods and technologies of foreign language scientific communication.
GC07	Ability to qualitatively present the results of scientific research.
GC08	Must have a systematic scientific worldview and general cultural outlook.
Professional competencies of the specialty (PC)	
PC01	Ability to perform and implement original innovative research, to achieve scientific results that create new knowledge in the field of avionics and related interdisciplinary areas and can be published in leading scientific publications in avionics and related fields.
PC02	Ability to use modern information technologies, databases and other electronic resources, specialized software in scientific and educational activities.
PC03	Ability to identify, pose and solve problems of a research nature in the field of avionics, evaluate and ensure the quality of research.
PC04	Ability to develop models, methods and algorithms to control aviation, space, robotics and other moving automatic or automated objects.
PC05	Ability to develop models, methods and technologies for diagnosing, maintenance and repair of avionics systems and complexes.
PC06	Ability to plan the work of the team to implement a research and innovation project, the implementation of educational and pedagogical work.
7 - Program results of learning	
PRL 1	Advanced conceptual and methodological knowledge in avionics and on the borders of subject areas, sufficient for scientific and applied research at the level of the latest world achievements in the relevant field, gaining new knowledge and / or innovation.
PRL 2	Professional terminology for presentation and discussion with specialists and non-specialists of research results, scientific and applied problems of avionics in state and foreign languages, qualified reflection of research results in scientific publications in leading international scientific journals.
PRL3	Basic legislative acts that regulate the relationship between the subjects of scientific and scientific and technical activities, including activities at the international level.
PRL 4	Develop and research conceptual, mathematical and computer models of processes and systems, effectively use them to gain new knowledge and / or create innovative products in the field of avionics and related interdisciplinary areas
PRL 5	Plan and perform experimental and / or theoretical research in avionics and related interdisciplinary areas using modern tools, critically analyze the results of their own research and the results of other researchers in the context of the whole set of modern knowledge about the research problem.

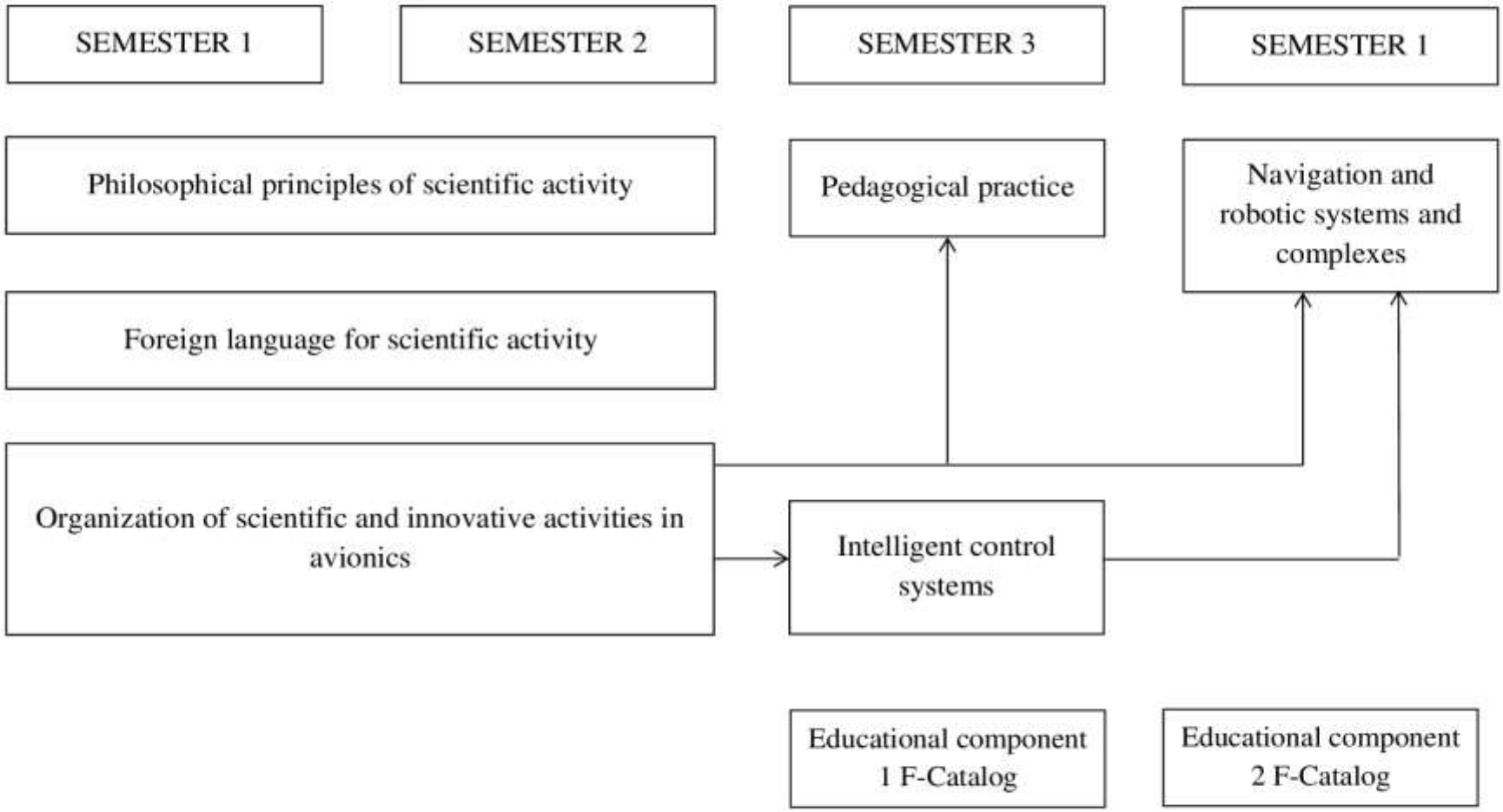
PRL 6	Implement software and hardware means and application packages for the design of control systems of aviation, rocket and outer space technologies, systems and devices in the relevant interdisciplinary areas on the basis of the conducted research.
PRL 7	Develop and analyze new algorithms for the operation of aircraft avionics in conditions of uncertainty and incompleteness of a priori information.
PRL 8	Analyze existing and synthesize new methods and models for diagnosing, maintaining and repairing avionics.
PRL 9	Summarize the results of scientific research in the form of scientific and technical reports, articles, abstracts, monographs, and transfer knowledge, decisions and the basis for their adoption to specialists and non-specialists in a clear and unambiguous form
PRL 10	Organize and implement international scientific and technical projects, including in a foreign language

8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the third level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the third level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition.
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the third level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition.
9 - Academic mobility	
National credit mobility	Exchange programs between partner universities, harmonization of the content of disciplines with the related disciplines of profile educational institutions, organization of dual education.
International credit mobility	Opportunities for exchange between partner universities of other countries, implementation of double degree programs and dual education with them. Participation in international educational programs. To determine knowledge and skills that students should acquire in the learning process, European standards and leading international standards of higher education for related specialties are taken into account.
Training of foreign applicants HE	Possibility to teach in English in separate academic groups with the provision of learning Ukrainian as a foreign language or in Ukrainian in joint groups with Ukrainian students.

2. LIST OF COMPONENTS OF THE EDUCATIONAL COMPONENT OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

Code	Components of the educational program (academic disciplines, course projects / works, practices)	Number of ECTS credits	Form final control
Obligatory (regulatory) components of the EP			
Educational disciplines for mastering general scientific competencies			
E1.1	Philosophical principles of scientific activity. Part 1. Scientific worldview and ethical culture of the scientist	2	Test
E1.2	Philosophical principles of scientific activity. Part 2. Philosophical epistemology and epistemology	4	Exam
Educational disciplines for acquiring language competencies			
E2.1	Foreign language for scientific activities. Part 1. Research	3	Test
E2.2	Foreign language for scientific activities. Part 2. Scientific communication	3	Exam
Educational disciplines for gaining in-depth knowledge of the specialty			
E3	Intelligent control systems	6	Exam
E4	Navigation and robotic systems and complexes	6	Exam
Educational disciplines for the acquisition of universal competencies of the researcher			
E5.1	Organization of scientific and innovative activities in avionics. Part 1. Fundamentals of scientific activity	2	Exam
E5.2	Organization of scientific and innovative activities in avionics. Part 2. Innovations in avionics	2	Test
E6	Pedagogical practice	2	Test
Selective components of the EP			
S1	Educational component of 1F catalog	5	Exam
S2	Educational component of 2F catalog	5	Exam
Total amount of obligatory educational components:		30	
The total amount of selective educational components:		10	
Total amount of the educational component of program		40	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. SCIENTIFIC COMPONENT

Year training	The content of the graduate student's scientific work	Form of control
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 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 individual plan of the graduate student's work at the academic council of the institute / faculty, reporting on the progress of the individual graduate 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 on the progress of the individual graduate 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 on the progress of the individual graduate 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 on the progress of the individual graduate student's plan twice a year Providing an opinion on the scientific novelty, theoretical and practical significance of the dissertation results.

5. FORM OF CERTIFICATION OF APPLICANTS FOR HIGHER EDUCATION

Certification for higher education under the educational program "Control Systems of Flight Vehicles and Complexes Engineering" specialty 173 "Avionics" is carried out in the form of open and public defense of qualifying work in several stages: plagiarism; presentation at the cathedral seminar with discussion and internal review; official defense and ends with the issuance of a standard document awarding him the degree of Doctor of Philosophy with the qualification: Doctor of Philosophy in Avionics. The dissertation after defense is placed in the repository of National Technical Library University for free access.

6. MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCIES TO COMPONENTS OF THE EDUCATIONAL PROGRAM

	E 1	E 2	E 3	E4	E5	E 6	scientific component
GC01	+		+	+			+
GC02	+	+	+	+	+	+	+
GC03		+				+	
GC04					+		+
GC05	+				+	+	
GC06		+					+
GC07					+	+	+
GC08	+				+		
PC01		+			+	+	+
PC02			+	+			
PC03					+		+
PC04			+	+			
PC05			+	+			
PC06					+	+	

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

	E 1	E 2	E 3	E4	E5	E 6	scientific component
PRL 1	+		+	+	+	+	+
PRL 2	+	+				+	+
PRL 3		+			+		
PRL 4			+	+			+
PRL5	+				+		+
PRL 6			+	+			
PRL 7			+	+			+
PRL8	+		+	+	+		+
PRL 9	+	+			+	+	+
PRL10		+			+	+	