

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
 NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
 «Igor Sikorsky Kyiv Polytechnic Institute»

APPROVED:

Igor Sikorsky Kyiv Polytechnic Institute Academic Council

(Protocol № 31743 dated 11.05.21)

Chairman of the Academic Council

Mykhailo ILCHENKO

Aerospace and rocket systems engineering

Educational and Professional Program

the first (Bachelor) level of higher education

specialty

134 Aerospace and rocket-space technology

field of knowledge

13 Mechanical engineering

qualification

Bachelor in Aerospace and rocket-space technology

Put into effect by order of the rector
 Igor Sikorsky Kyiv Polytechnic Institute
 from 2021/2022

Kyiv – 2021



PREAMBLE

DEVELOPED by the project team:

The project team chairman

Oleksandr Arhipov, Doctor of Technical Sciences, Professor,
Professor of the Department of space engineering. guarantor of Bachelor program «**Aerospace and rocket systems engineering**»

The project team members:

Ivan Korobko Doctor of Technical Sciences, Director of the Institute of Aerospace Technologies

Vitaliy Suhov Сухов, Doctor of Technical Sciences, Professor, Professor of the Department of Aircraft and Rocket Engineering

Oleksandr Marynoshenko PhD in Engineering sciences, Associate Professor , acting Head of the Department of space engineering,

Oleksandr Bondarenko, PhD in Engineering sciences, Associate Professor of the Department of Aircraft and Rocket Engineering

AGREED:

Scientific and methodical commission of Igor Sikorsky KPI on specialty 134 " Aerospace and rocket-space technology ":

Head SMC 134
(protocol № ___ from ___)

Volodymyr Kabanyachyi

Methodical Council of Igor Sikorsky Kyiv Polytechnic Institute

Head of the Methodical Council
(protocol № ___ from ___)

Yuriy YAKYMENKO

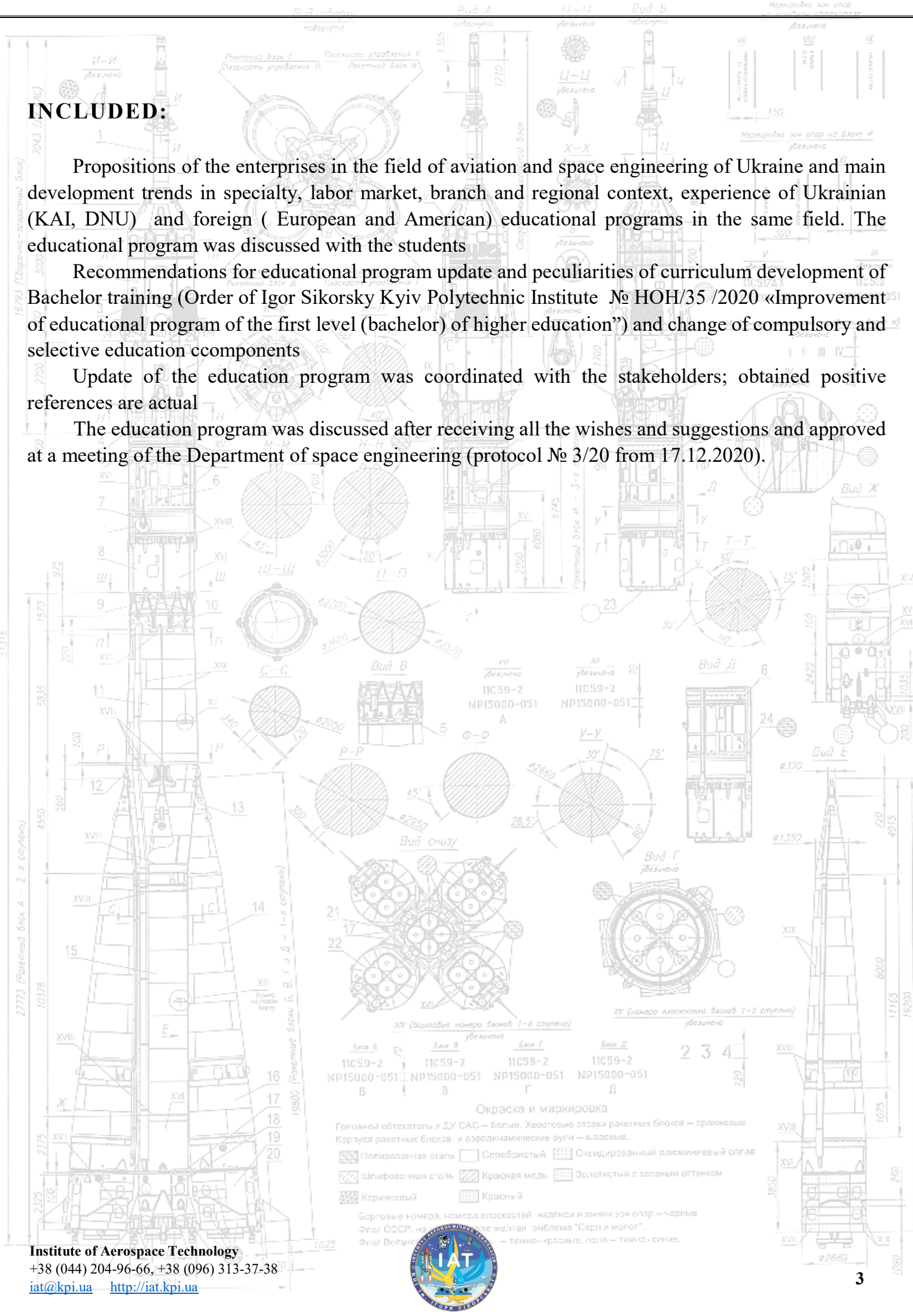
INCLUDED:

Propositions of the enterprises in the field of aviation and space engineering of Ukraine and main development trends in specialty, labor market, branch and regional context, experience of Ukrainian (KAI, DNU) and foreign (European and American) educational programs in the same field. The educational program was discussed with the students

Recommendations for educational program update and peculiarities of curriculum development of Bachelor training (Order of Igor Sikorsky Kyiv Polytechnic Institute № HOH/35 /2020 «Improvement of educational program of the first level (bachelor) of higher education”) and change of compulsory and selective education components

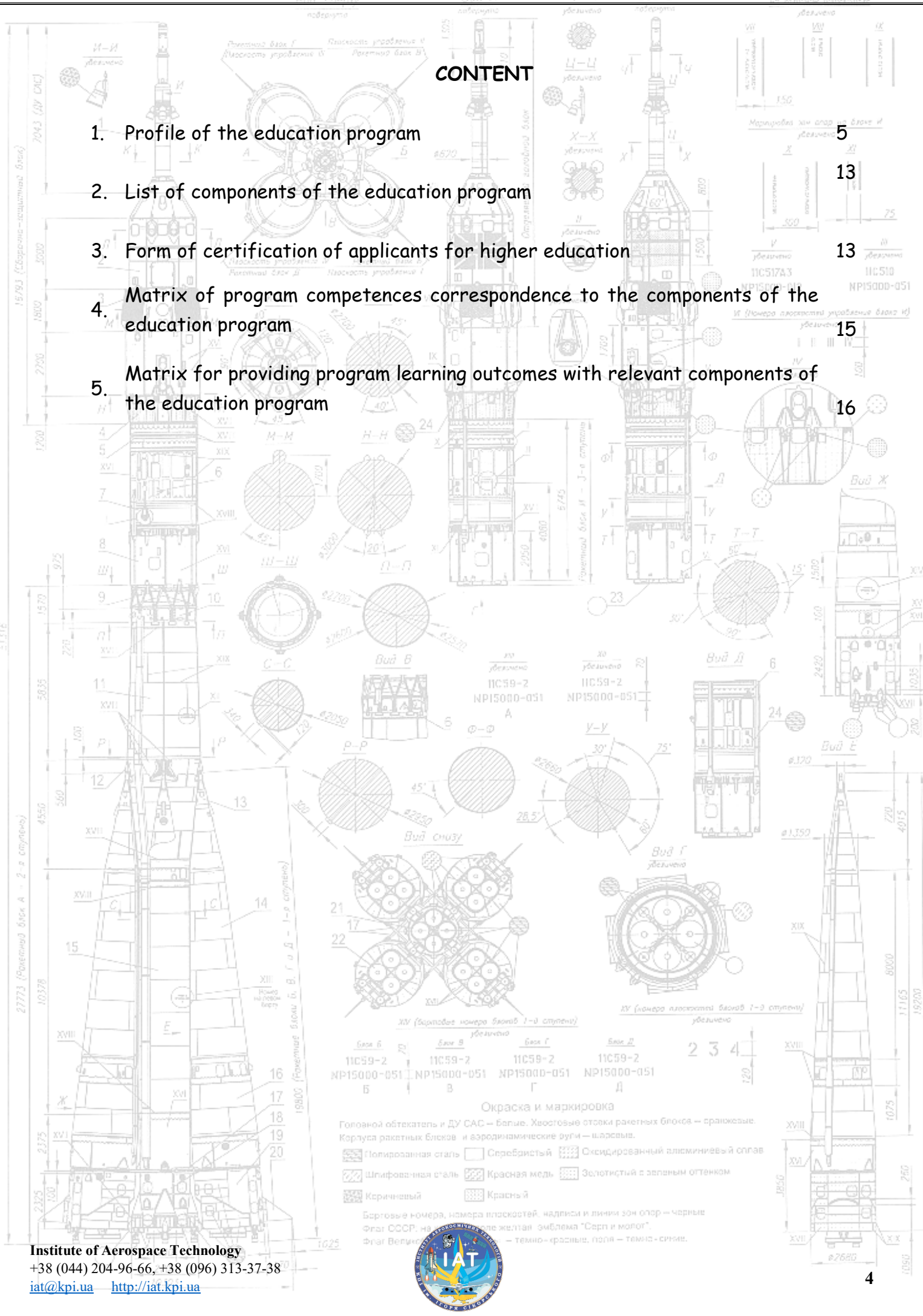
Update of the education program was coordinated with the stakeholders; obtained positive references are actual

The education program was discussed after receiving all the wishes and suggestions and approved at a meeting of the Department of space engineering (protocol № 3/20 from 17.12.2020).



CONTENT

1. Profile of the education program 5
2. List of components of the education program 13
3. Form of certification of applicants for higher education 13
4. Matrix of program competences correspondence to the components of the education program 15
5. Matrix for providing program learning outcomes with relevant components of the education program 16



Блок Б	Блок В	Блок Г	Блок Д
11С59-2	11С59-2	11С59-2	11С59-2
NP15000-051	NP15000-051	NP15000-051	NP15000-051
Б	В	Г	Д

Окраска и маркировка
 Головной обтекатель и ДУ САС – белые. Хвостовые отсеки ракетных блоков – оранжевые.
 Корпуса ракетных блоков и аэродинамические руги – черные.
 Полированная сталь Спиробристый Оксидированный алюминиевый сплав
 Шлифованная сталь Красная медь Золотистый с зеленым оттенком
 Коричневый Красный

Барные номера, номера плоскостей, надписи и линии зон отор – черные
 Флаг СССР, надпись «Союз» – желтая эмблема «Серп и молот»
 Флаг Великого Отечества – темные красные, голубые – темные синие.



1.PROFILE OF THE EDUCATIONAL PROGRAM

on the specialty 134 " Aerospace and rocket-space technology "

1 - General information	
Full name of HEI and institute / faculty	NATIONAL TECHNICAL UNIVERSITY OF UKRAINE «Igor Sikorsky Kyiv Polytechnic Institute», Institute of Aerospace Technologies
Degree of higher education and title of qualification in the original language	Degree of HE - Bachelor Educational qualification -Bachelor in Aerospace and rocket-space technology
Cycle / level of HE	NQF of Ukraine - level 7 QF-EHEA - the second cycle EQF-LLL - level 7
The official name of the EP	Aerospace and rocket systems engineering
Type of diploma and scope of EP	Bachelor Diploma, single, 240 ECTS credits, training period 3 year and 10 months
Availability of accreditation	accreditation certificate of specialty UD 11010593, valid till 01.07.2029
Cycle/level of higher education	NQF of Ukraine - level 6 QF-EHEA - 1st cycle EQF-LLL - level 6
Prerequisites	The presence of senior secondary education
Language (s) of teaching	Ukrainian
Validity of the EP	Until the next accreditation
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/op , http://ki.kpi.ua розділ «Освітні програми»



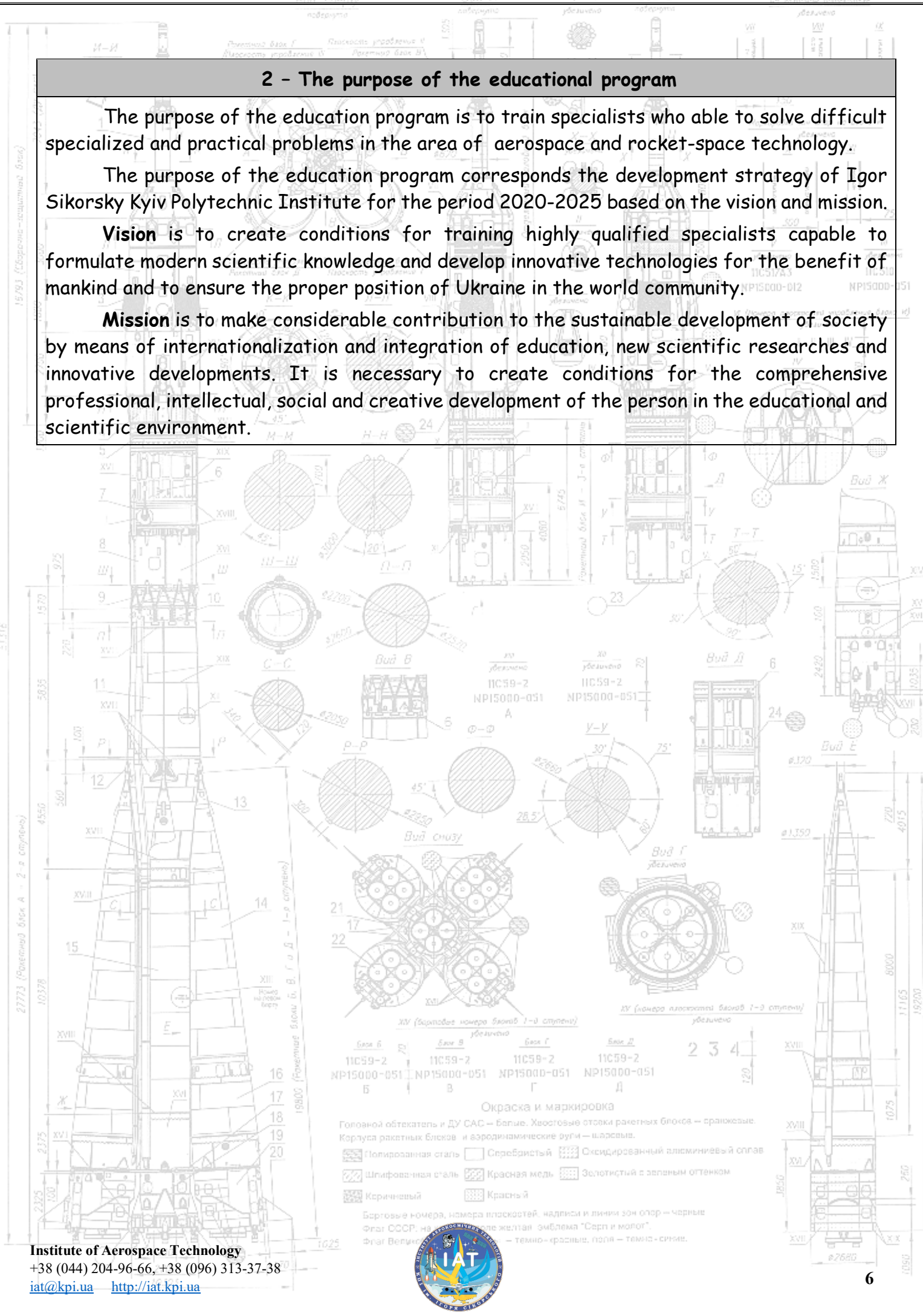
2 - The purpose of the educational program

The purpose of the education program is to train specialists who are able to solve difficult specialized and practical problems in the area of aerospace and rocket-space technology.

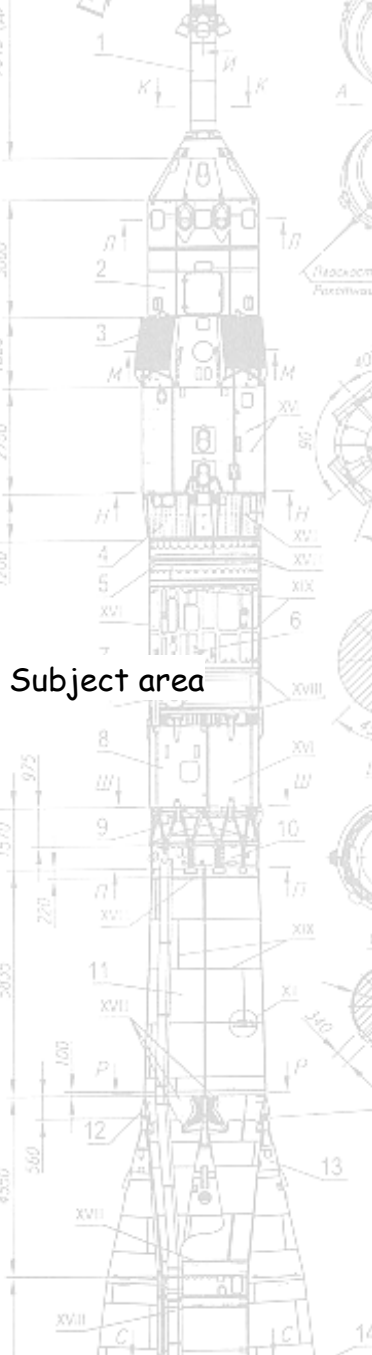
The purpose of the education program corresponds to the development strategy of Igor Sikorsky Kyiv Polytechnic Institute for the period 2020-2025 based on the vision and mission.

Vision is to create conditions for training highly qualified specialists capable to formulate modern scientific knowledge and develop innovative technologies for the benefit of mankind and to ensure the proper position of Ukraine in the world community.

Mission is to make considerable contribution to the sustainable development of society by means of internationalization and integration of education, new scientific researches and innovative developments. It is necessary to create conditions for the comprehensive professional, intellectual, social and creative development of the person in the educational and scientific environment.



3 - Characteristics of the education program

 <p>Subject area</p>	<p>Objects of study - phenomena and problems related to the stages of the life cycle of aerospace and rocket-space technology.</p> <p>Purpose of study is to train specialists able to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket-space technology, its engines and power plants, structures and systems characterized by the uncertainty of conditions.</p> <p>Theoretical content of subject area are theoretical basics of development and manufacturing of aerospace and rocket-space objects and technologies.</p> <p>Methods, techniques and technologies- analytical, numerical and experimental methods of research of problems of the subject area, especially integrated computer technologies, techniques and technologies dealing with the stages of the life cycle of aerospace and rocket-space technology.</p> <p>Tools and equipment: laboratory measuring equipment with measuring facilities i.e. hydraulic stands, wind tunnels, equipment for investigation of materials properties, stress-strain state of constructions; tools and equipment for studying structure of airplanes, helicopters, rockets, engines and power plants, onboard, navigation, electric equipment; equipment for manufacturing, assembling and testing of aerospace and rocket-space objects, computers with information and specialized software for calculation and geometrical modelling, finite-element analysis, integrated design and production of aerospace and rocket-space technology.</p>
<p>15</p> <p>Orientation of the EP</p>	<p>Educational and professional</p> <p>It is focused on rocket and space vehicles design and aerospace engineering.</p>
<p>The main focus of EP</p>	<p>The program is based on the common scientific statements including the current state of aerospace branch development. The program focuses on actual information and manufacturing technologies facilitating further professional and scientific career.</p> <p>Key words: rockets, space vehicles, airspace engineering</p>



<p>Features of EP</p>	<p>Program realization implies the engaging of practitioners and experts in the professional field, employer representatives to teach students. Practice and part-time employment starting from the 3rd year of study are conducted at profile enterprises. Some disciplines are taught in foreign language.</p>
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4 – Suitability of graduates for employment and further study

<p>Suitability for employment</p>	<p>SC 003:2010, Codes: 3115 Technical mechanic 3121 Technician-programmer</p>
<p>Further training</p>	<p>Continuing study at the second (master) level of higher education and / or obtaining additional qualifications in post graduate study.</p>

5 – Teaching and assessment

<p>Teaching and learning</p>	<p>Lectures, seminars, practical classes, computer practicums, laboratory work, course projects and works, practice and excursions, diploma project are the main forms of study.</p>
<p>Assessment</p>	<p>Written and oral exams, testing according to the Rating system of assessment adopted by Igor Sikorsky Kyiv Polytechnic Institute are conducted including all forms practical and self-directed study. Final attestation is presented in the form of diploma project.</p>

6 – Program competences

<p>Integral competence</p>	<p>Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket-space technology, which implies the application of theories and methods of physics, mathematics and engineering sciences and characterized by the complexity and uncertainty of conditions.</p>
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General Competences

<p>GC1</p>	<p>Ability to use Ukrainian language for written and oral communication</p>
<p>GC2</p>	<p>Ability to use foreign language for communication</p>
<p>GC3</p>	<p>Ability to carry out safe activity and aspiration to save environment.</p>
<p>GC4</p>	<p>Ability to use information and communicative technology</p>
<p>GC5</p>	<p>Ability to work in team</p>
<p>GC6</p>	<p>Ability to generate new ideas (creativity)</p>



GC7	Ability to make reasonable decisions.
GC8	Ability to study and master modern knowledge.
GC9	Ability to realize duties and responsibilities as a member of society, values of free democratic society and the necessity of its sustainable development, supremacy of law, rights and freedoms of human and citizen of Ukraine.
GC10	Ability to save and enrich moral, cultural, scientific values and achievements based on the knowledge of history and trends of subject area development, its place in the common system of knowledge about nature and society and society development, technics and technologies, apply different kinds and forms of physical activity for leisure and healthy life style.
GC11	Ability to work autonomously.
GC12	Ability to organize and use collaborative discussions of methods for solving unusual design problems.
GC13	Ability to interpersonal relation.
Professional competences (PC)	
PC1	Ability to use the theory of flight dynamics and control at designing of aerospace and rocket-space technology
PC2	Ability to use knowledge of hydraulics, air and gas dynamics to describe the interaction of bodies with gas and hydraulic environment
PC3	Ability to choose the optimal materials for the construction components of aircraft and rocket and space technology.
PC4	Ability to calculate the strength of components of aircraft and rocket and space technology
PC5	Ability to design and test the components of aircraft and rocket and space technology, its equipment, systems and subsystems
PC6	Ability to develop and implement technological processes of aircraft and rocket and space technology manufacturing
PC7	Skills to use information and communicative technologies and specialized software in studying and professional activity
PC8	Ability to consider economic and managerial aspects of aircraft and rocket and space technology manufacturing in professional activity
PC9	Ability to develop general construction of aircraft and rocket and space technology
PC10	Ability to carry out diagnostics and testing of aircraft and rocket and space technology and its vibrational protection



PC 11	Ability to determine the optimal type and parameters of rocket and space vehicle power plant
PC 12	Ability to plan wind tunnel experiments and to control their implementation
PC 13	Ability to provide metrological support, standardization and certification of structural elements of rocket and space vehicles by means of calculation methods and considering technological and functional interchangeability
PC 14	Skills to use integral technologies of computer design and modelling of aircraft and rocket and space systems and elements

7 - Program results of learning

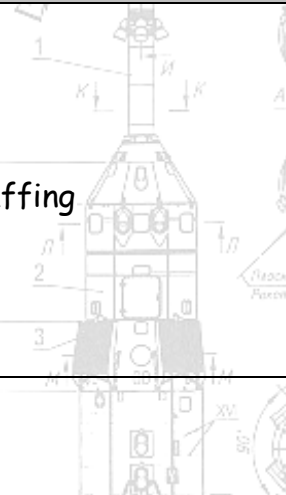
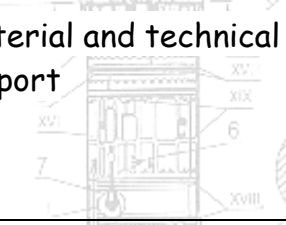
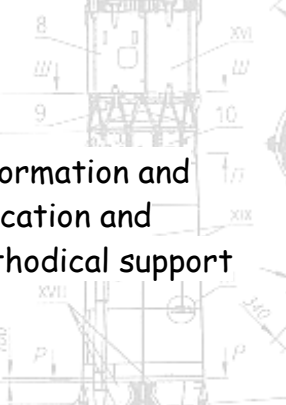
PRL 1	Ability to know aerodynamic modelling and assess rocket parameters by means of specialized computer means and wind tunnel experiments
PRL 2	Knowledge of development methods of modern applied software for conducting quick nonstandard calculation or analyzing huge amounts of data
PRL 3	Understand environmentally dangerous and harmful factors of professional activity and regulate its content in order to avoid negative effect on environment
PRL 4	Understand the principles of gas and liquid mechanics, as well as, hydraulics, aerodynamics (gas dynamics)
PRL 5	Understand the features of working processes in hydraulic, pneumatic, electric and electronic systems, servo motors used in aircraft and rocket and space technology
PRL 6	Understand and reason the sequence in design, production, testing and/or certification of aircraft and rocket and space objects and elements at all stages of their life cycle.
PRL 7	Understand the structure and principles of operation of onboard and navigation equipment of aircraft and rocket and space technology
PRL 8	Understand and reason the features of structure based on main aspects of working processes in aircraft and rocket and space elements and systems
PRL 9	Understand the theoretical principles and practical methods of equipment support of components interchangeability of aircraft and rocket and space technology
PRL 10	Describe the models and stress-strain state of aircraft mechanical structures and elements by means of modern integral technologies of computer design
PRL 11	Develop the structure of rocket and space vehicles
PRL 12	Calculate the power plants of rockets and space vehicles: pulse engines, gas and gas turbine engines, flywheel engines, liquid and solid fuel rocket engines, solar batteries, generators, servo motors.
PRL 13	Conduct diagnostics and nondestructive control of flying vehicles elements.
PRL 14	Master the modern means of information and communicative technologies in the amount sufficient for studying and professional activity.




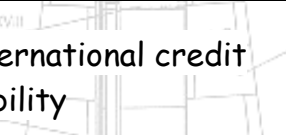
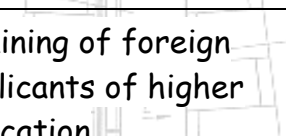
PRL 15	Acquire logics and methodology of scientific cognition based on understanding of modern state and methodology of subject area
PRL 16	Describe metals and nonmetals and know modification methods of their properties. Determine optimal materials for aircraft and rocket and space elements considering their structure, physical, mechanical, chemical and operational properties, as well as, economic factors
PRL 17	Describe experimental research methods of structural, physical and mechanical technological properties of materials and structures.
PRL 18	Apply modern methods of modelling, design and manufacturing of aircraft and rocket and space elements and systems
PRL 19	Acquire skills of determining structural elements stress of aircraft and rocket and space technology at all stages of their life cycle
PRL 20	Calculate stress-strain state, determine carrying capacity of structural elements and reliability of aircraft and rocket and space technology
PRL 21	Skills to develop technological processes using computer aided design to manufacture the structural components of aircraft and rocket and space technology
PRL 22	Explain the influence of structural parameters of rocket and space vehicles on their performance. Know methods of stability and controllability of aircraft and rocket and space technology
PRL 23	Ability to use Ukrainian and foreign languages for fluent oral and written communication in professional activity
PRL 24	Explain solutions and give arguments in their favor in reasonable and clear form
PRL 25	Skills for self-directed study and autonomous work for increasing professional qualification and solving the problems in new and unknown environment
PRL 26	Formulate the reasonable assessment of governmental organizations activity, political institutions from the point of view of mankind, democratic values, human rights and freedoms priority
PRL 27	Follow the requirements of branch documentation dealing with the design procedures, manufacturing, testing and/or certification of aircraft and rocket and space systems and their elements at all stages of life cycle
PRL 28	Assess economic efficiency of manufacturing of aircraft and rocket and space systems and elements



8 - Resource support for program implementation

<p>Staffing</p> 	<p>Exchange programs of students and lecturers between partner universities, coordination of the content of disciplines with the related disciplines of profile educational institutions are possible.</p> <p>In accordance with the personnel requirements for ensuring the implementation of education activities for the particular level of higher education approved by the Resolution of the Cabinet of Ministers of Ukraine № 1187 dated 30.12.2015 (with changes according to RCMU № 347 dated 10.05.2018).</p>
<p>Material and technical support</p> 	<p>In accordance with the technological requirements for material and technical support of education activities of the particular level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine № 1187 dated 30.12.2015 (with changes according to RCMU № 347 dated 10.05.2018).</p> <p>Equipment for lectures in the form of presentations, network technologies using Sikorsky platform</p>
<p>Information and education and methodical support</p> 	<p>In accordance with the technological requirements for education and methodological and information support of education activities of the particular level of higher education approved by the Resolution of the Cabinet of Ministers of Ukraine № 1187 dated 30.12.2015, (with changes according to RCMU № 347 dated 10.05.2018).</p> <p>Applicants of higher education use information resources and studying environment of KPI library.</p>

9 - Academic Mobility

<p>National credit mobility</p> 	<p>Agreement on academic mobility is signed with Dnipro National University</p>
<p>International credit mobility</p> 	<p>Students take part in the programs of academic mobility (Erasmus + KI) with the University of the Basque Country (Spain), Warsaw University of Technology (Polland), ENS Lyon (France).</p>
<p>Training of foreign applicants of higher education</p> 	<p>Foreign students have the ability to study in separate groups in English with the studying of Ukrainian as a foreign language. In mixed groups they are trained in Ukrainian language.</p>



2. LIST OF COMPONENTS OF EDUCATION PROGRAM

Code	Components of education program (academic disciplines, course projects / works, practices)	Number of ECTS credits	Form of final control
1	2	3	4
Compulsory (regulatory) components of the EP			
General training cycle			
30 1	Ukrainian language for professional purposes	2	Credit
30 2	History of science and technology	2	Credit
30 3	Basics of a healthy lifestyle	3	Credit
30 4	Foreign language	6	Credit
30 5	Economics and Management of Enterprise	4	Credit
30 6	Labor Safety and Civil Defence	4	Credit
30 7	General theory of development	2	Credit
30 8	Environmental safety of engineering activities	2	Credit
30 9	Business law	2	Credit
30 10	Foreign language for professional purposes	6	Credit /Exam

Professional training cycle			
ПО 1	Higher mathematics	18	Exam
ПО 2	Physics	10	Exam
ПО 3	Chemistry	3	Credit
ПО 4	Theoretical mechanics	10	Exam
ПО 5	Electrical engineering and electronics	3	Credit
ПО 6	Descriptive geometry	3	Credit
ПО 7	Engineering and computer graphics	4	Credit
ПО 8	Theory of mechanisms and machines	4	Credit
ПО 9	Materials and Constructions Mechanics	7,5	Exam
ПО 10	Machines Details and Basics of Aircraft Designing	5	Exam
ПО 11	Hydrogas dynamics and thermodynamics	6,5	Exam
ПО 12	Engineering basics of aviation and astronautics	4	Credit
ПО 13	Aircraft structure	4	Exam
ПО 14	Course project on Aircraft structure	1,5	Credit



ПО 15	Design of satellites	5	Exam
ПО 16	Technical measuring and certification	4	Exam
ПО 17	Metrology and standardization	4	Exam
ПО 18	Theory of automatic control	5	Exam
ПО 19	Course work in the theory of automatic control	1	Credit
ПО 20	Aerodynamics of Aircraft	4,5	Credit
ПО 21	Aerospace materials science	4	Credit
ПО 22	Flight Dynamics	3,5	Exam
ПО 23	Technology of production of aircraft and engines	4	Exam
ПО 24	Course work in the technology of production of aircraft and engines	1	Credit
ПО 25	Information technologies and general methods of application software development	9	Credit
ПО 26	Design of rocket and spacecraft power plants	6,5	Exam
ПО 27	Pre-diploma practice	6	Credit
ПО 28	Diploma design	6	Defence

Selective components of EP

General training cycle

ЗВ 1	Educational component of 1F catalog	2	Credit
ЗВ 2	Educational component of 2F catalog	2	Credit

Professional training cycle

ПТВ 1	Educational component of 1F catalog	4	Credit
ПТВ 2	Educational component of 2F catalog	4	Credit
ПТВ 3	Educational component of 3F catalog	4	Credit
ПТВ 4	Educational component of 4F catalog	4	Credit
ПТВ 5	Educational component of 5F catalog	4	Credit
ПТВ 6	Educational component of 6F catalog	4	Credit
ПТВ 7	Educational component of 7F catalog	4	Credit
ПТВ 8	Educational component of 8F catalog	4	Credit
ПТВ 9	Educational component of 9F catalog	4	Credit
ПТВ 10	Educational component of 10F catalog	4	Credit
ПТВ 11	Educational component of 11F catalog	4	Credit
ПТВ 12	Educational component of 12F catalog	4	Credit



ТВ 13	Educational component of 13F catalog	4	Credit
ТВ 14	Educational component of 14F catalog	4	Credit
Total amount of compulsory education components:		180	
The total amount of selective education components:		60	
TOTAL AMOUNT OF EDUCATION PROGRAM COMPONENTS		240	

4. Matrix of program competences correspondence to the components of education program

	30 1	30 2	30 3	30 4	30 5	30 6	30 7	30 8	30 9	30 10	ПО1	ПО2	ПО3	ПО4	ПО5	ПО6	ПО7	ПО8	ПО9	ПО10	ПО11	ПО12	ПО 13	ПО 14	ПО 15	ПО 16	ПО 17	ПО 18	ПО 19	ПО 20	ПО 21	ПО 22	ПО 23	ПО 24	ПО 25	ПО 26	ПО 27	ПО 28		
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5. Matrix for providing program learning outcomes with relevant components of education program

	30 1	30 2	30 3	30 4	30 5	30 6	30 7	30 8	30 9	30 10	ПО1	ПО2	ПО3	ПО4	ПО5	ПО6	ПО7	ПО8	ПО9	ПО10	ПО11	ПО12	ПО13	ПО14	ПО15	ПО16	ПО17	ПО18	ПО19	ПО20	ПО21	ПО22	ПО23	ПО24	ПО25	ПО26	ПО27	ПО28		
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