

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 № 031743 dated 11.05.2021)

Chairman of the Academic Council

Mykhailo ILCHENKO

Aerospace and rocket systems engineering

EDUCATIONAL AND PROFESSIONAL PROGRAM

second (master) level of higher education

specialty

134 Aerospace and rocket-space technology

field of knowledge

13 Mechanical engineering

qualification

Master in Aerospace and rocket-space technology

Put into effect by order of the rector
 Igor Sikorsky Kyiv Polytechnic Institute
 from _____



PREAMBLE

DEVELOPED by the project team:

The project team chairman

Oleksandr Marynoshenko PhD in Engineering sciences, Associate Professor , Head of the Department of space engineering, guarantor of Master program «**Aerospace and rocket systems engineering**»

The project team members:

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

Volodymyr Kabanyachyi, Doctor of Technical Sciences,
acting Head of the Department of Aircraft and Rocket Engineering

Oleksandr Arhipov, Doctor of Technical Sciences, Professor,
Professor 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

Yuriy YAKYMENKO

(protocol № ___ from ___)

INCLUDED:

propositions of the enterprises in the field of aviation and space engineering of Ukraine

- Director of Firefly Aerospace Ukraine Company **Dondyk O.V.**
- Deputy Director of State Kyiv Design Bureau “Luch” **Ykovenko P.O.**;

main development trends in specialty, labor market, branch and regional context, experience of Ukrainian (KAI, DNU) and foreign (European and American) education programs in the same field. The education program was discussed at the meetings with the students.

Recommendations for education and professional program update are set due to:

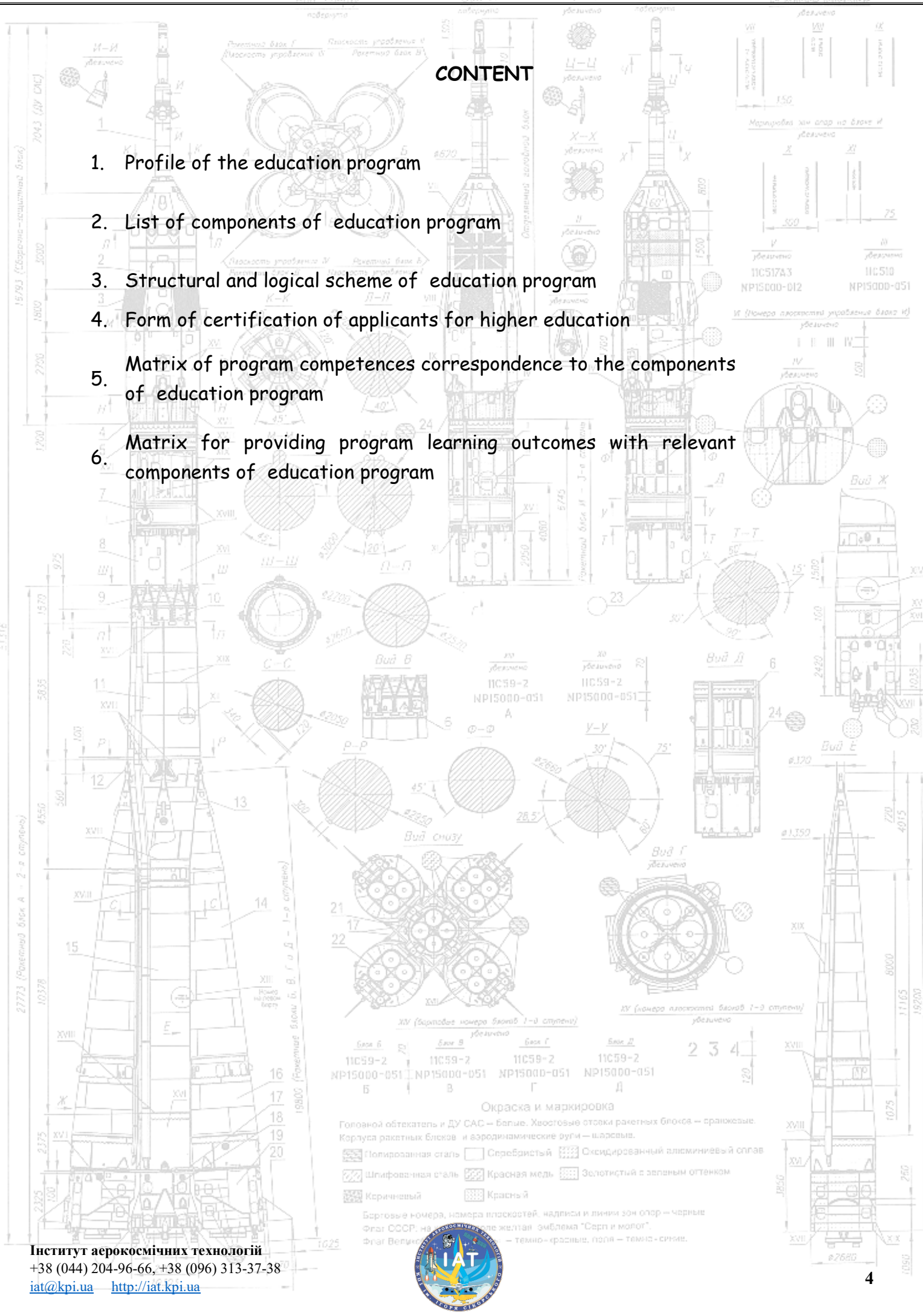
- redistribution of ECTS credits between the program components;
- change of National qualification frame (Resolution of the Cabinet of Ministers of Ukraine dated 25.06.2020 № 519)
- according to the Order of MINISTRY OF EDUCATION AND SCIENCE/18/2021 dated 01.02.2021 “ Organization and planning of education process for the period 2021-2022”

The education program was discussed after receiving all the wishes and suggestions from students, graduates, academic community representatives, employers 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
2. List of components of education program
3. Structural and logical scheme of education program
4. Form of certification of applicants for higher education
5. Matrix of program competences correspondence to the components of education program
6. Matrix for providing program learning outcomes with relevant components of education program



1 - Загальна інформація

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 -Master Educational qualification -Master 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-space technology
Type of diploma and scope of EP	Master Diploma, single, 90 credits, training period 1 year and 4 months
Availability of accreditation	EP accreditation certificate -1027, valid till 01.07.2026
Prerequisites	The presence of Bachelor degree
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://iat.kpi.ua



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 and carry out innovative professional activity.

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

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 educational program

Subject area

Objects of study - phenomena and problems related to the stages of the life cycle of aerospace and rocket-space objects and systems which require knowledge update and integration in the condition of insufficient information and controversial requirements.

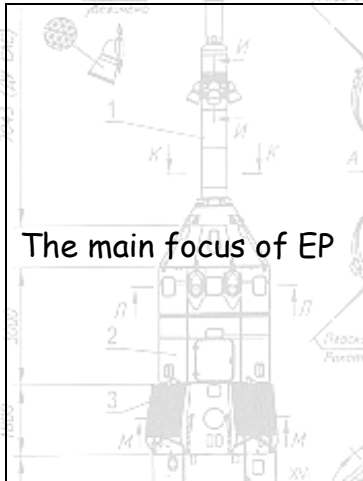
Theoretical content of the subject area - physical processes models in aerospace and rocket-space objects, modern concepts of solid body deformation mechanics, aero- and gas dynamics, thermophysics and electrical engineering.

Methods, techniques and technologies - modern analytical, numerical and experimental methods of research of problems of the subject area, techniques and technologies for solving complicated problems and tasks related to the stages of the life cycle of aerospace and rocket-space objects.

Tools and equipment: laboratory measuring equipment, hydraulic stands, wind tunnels, equipment for investigation of materials properties, stress-strain state of constructions; equipment for assembling and testing of aerospace and rocket-space objects, computers and software for design and production of aerospace and rocket-space structures.

Orientation of the EP

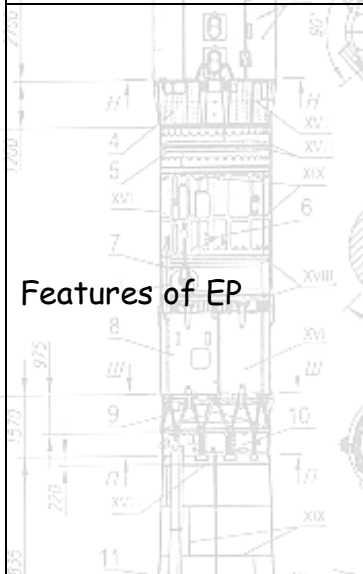
Educational and professional



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: computer technology for system and process modelling, work with data bases, composite materials, technical objects diagnostic and control.

Great attention is paid to the development of rocket-space vehicles structures, airspace engineering.

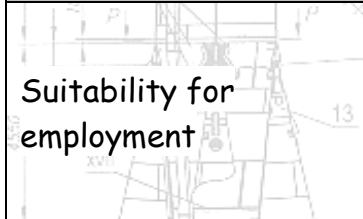
Key words: rockets, space vehicles, airspace engineering



Studying is conducted using the elements of dual education. Higher education in the field of aerospace and rocket-space technology, its physical basics, materials and technologies, mastering of additional fundamental and profession-oriented disciplines provide the obtaining of the required competences for further professional activity.

The program is aimed at formulating the ability to identify and solve complex tasks in the field of 13 Mechanical engineering within the specialty 134 Aerospace and rocket-space technology. The program enables students to choose disciplines according to the department profile.

4 - Suitability of graduates for employment and further study



SC 003:2010, Codes:
 2145. Professionals in the field of Mechanical Engineering
 2145.1 Junior Research Fellow (Engineering mechanics)
 2145.2 Engineer- designer (mechanics)



Continuing study at the third (educational and scientific) level of higher education and / or obtaining additional qualifications in adult education system.

5 - Teaching and assessment



General educational style is problem-oriented. Lectures, seminars, practical classes, laboratory work in small groups (8 students), self-directed work with the teachers consultancy, individual study using information-communicative technology (Pro/Engineer, CATIA, Nastran, FEMAP, ODBMS Space) are the main form of study.

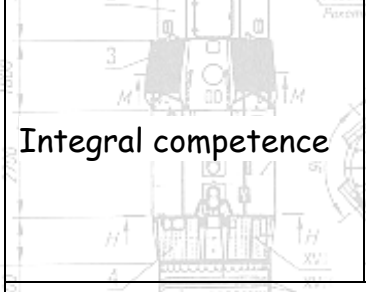




Assessment

Current control is presented in the form of laboratory report, calculation work, summaries. Semester control is presented in the form of written and oral exams and defense of qualification projects. Assessment is performed according to the Rating system of assessment adopted by Igor Sikorsky Kyiv Polytechnic Institute including all forms of study.

6 - Program competences



Integral competence

Ability to solve complex problems and tasks in the professional activity dealing with the development, manufacturing and (or) certification of aerospace and rocket-space technology, structures and systems or during the studying process including researching and (or) innovations and characterized by the uncertainty of conditions and requirements.

General Competences

GC 1 Ability to abstract thinking, analysis and synthesis.

GC 2 Ability to identify, formulate and solve problems

GC 3 Ability to carry out researches for solving complicated tasks in professional area and scientific and technical activity

GC 4 Ability to generate new ideas and provide them in the form of innovative solutions cooperating with the representatives from different professional teams.

GC 5 Ability to use modern information technology.

GC 6 Ability to adapt and work in new environment.

GC 7 Ability to be careful and laborious to the tasks and responsibilities.

GC 8 Ability to provide autonomous and self-directed study based on modern scientific and technical achievements.

GC 9 Ability to use foreign language for professional (scientific and technical) activity.

GC 10 Ability to master new research methods and to change scientific and production profile of activity

GC 11 Ability to work in the team in order to implement effectively the stated tasks.

Professional competences

PC 1 Ability to know history, current state, problems and development trends of aircraft and rocket and space technology.

PC 2 Ability to choose the optimal materials for the construction elements of aircraft and rocket and space technology.

PC 3 Ability to evaluate technical and economic efficiency of the design, researches, technological processes, and innovations.

PC 4 Ability to describe the models of working processes of aircraft and rocket and space technology systems and elements required to understand, describe, improve aircraft and rocket and space objects and to optimize their parameters.

PC 5 Ability to state and solve professional problems by means of base knowledge in hydraulic, pneumatic, electrical and electronic systems

PC 6 Ability to conduct work dealing with production preparation of aircraft and rocket and space objects using new technologies.

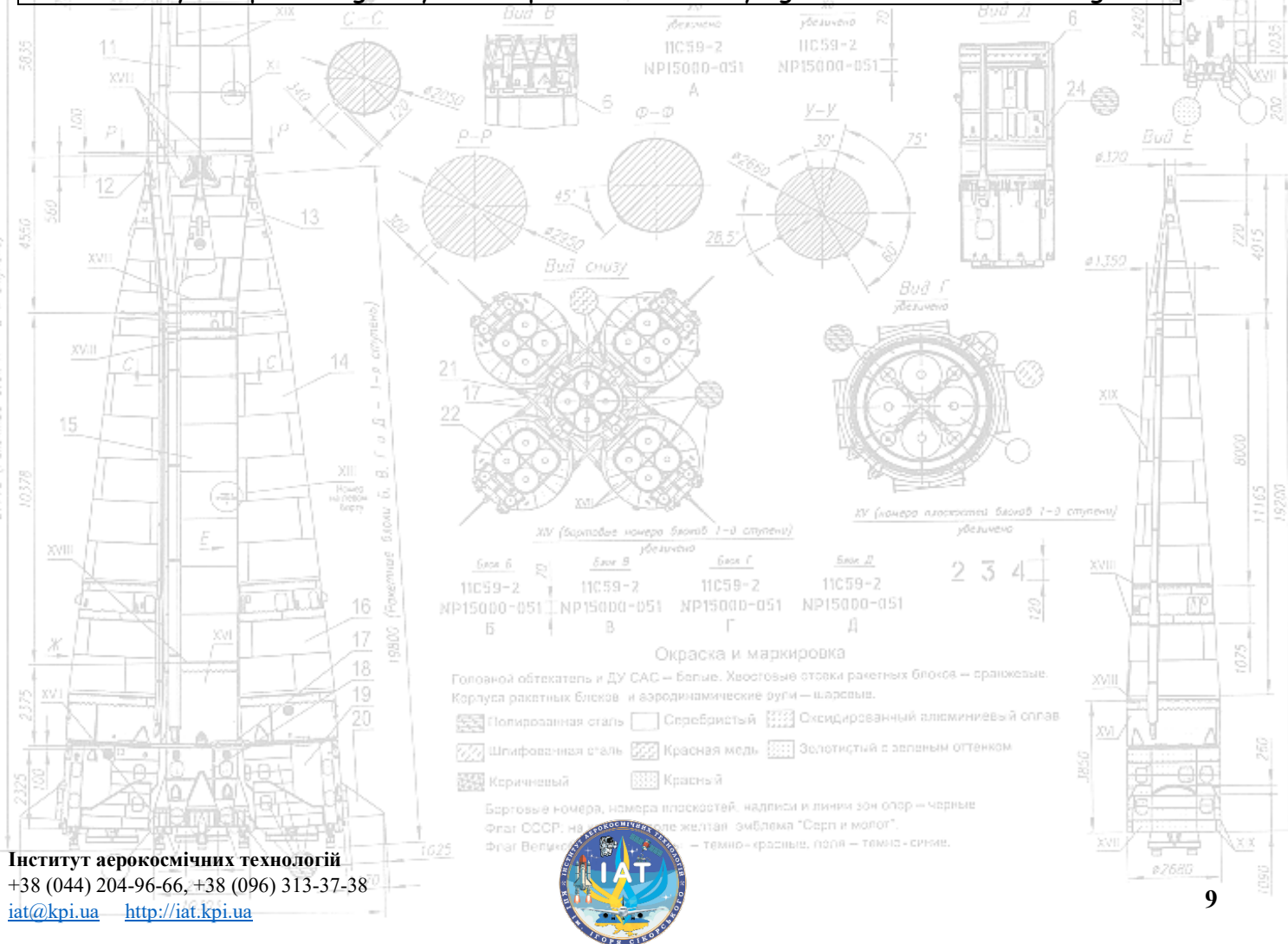
PC 7 Ability to implement physical and mathematical models of systems and processes by means of modern information technology methods

PC 8 Ability to develop the control systems of flying vehicles

PC 9 Ability to design and test elements and units of aircraft and rocket and space vehicles

PC 10 Ability to design and use modern systems of aircraft and space objects

PC 11 Ability to optimize gas dynamics parameters of flying vehicles and rocket engines.



7 - Program results of learning

PRL 1 Ability to solve complex engineering problems and tasks of aircraft and/or rocket and space technology that require knowledge update and integration in the condition of insufficient information and controversial requirements.

PRL 2 Ability to write reporting documentation according to the results of work deals with the professional (scientific and technical) tasks, scientific publications, reports and presentations relating to the performed research.

PRL 3 Ability to use new specialized software to solve complex problems in professional (scientific and technical) activity according to educational program.

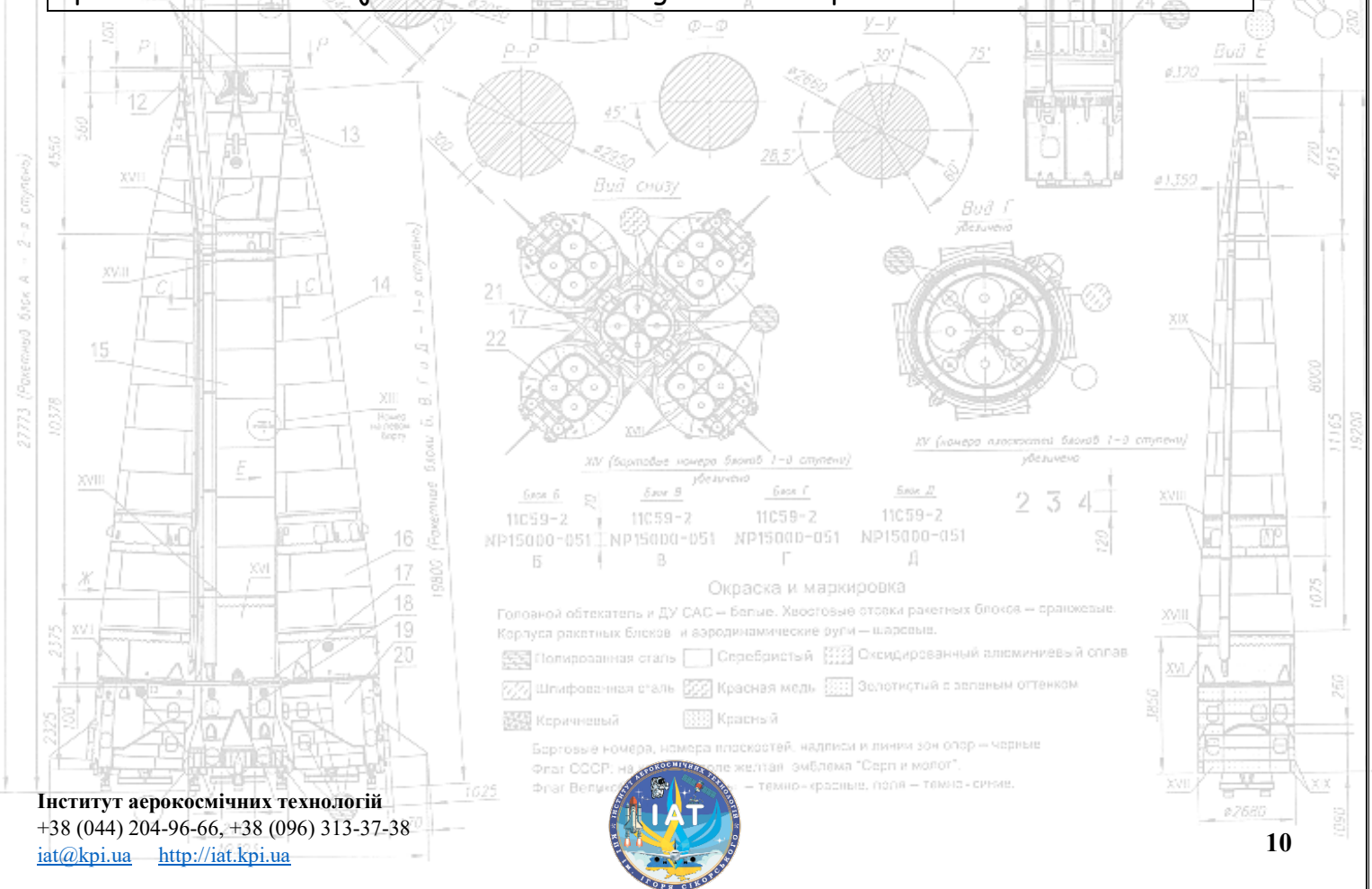
PRL 4 Ability to make decisions to solve unusual complex tasks in professional (scientific and technical) activity integration in the condition of requirements uncertainty, range of ideas and limit of time.

PRL 5 Ability to be responsible for the development of professional knowledge and team work in aircraft and/or rocket and space technology, its strategic development evaluation.

PRL 6 Knowledge sufficient to continue study in the field of aircraft and rocket and space technology, mechanical engineering and relating branches of knowledge and which is autonomous and self-directed one.

PRL 7 Knowledge of foreign language allowing communicating in professional environment and using of scientific and technical documentation in the subject area.

PRL 8 Ability to use historical, patent and scientific and technical literature, analyze new scientific and technical achievements in designing and producing aircraft and rocket and space elements and objects at different stages of development.

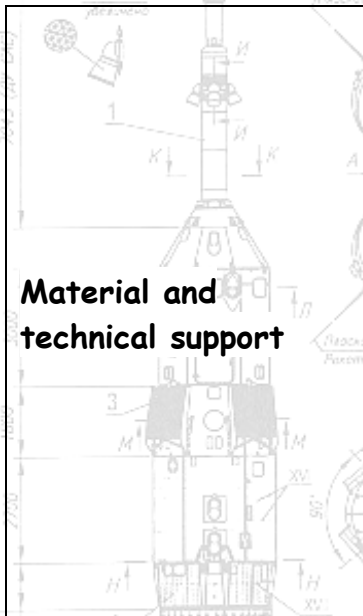
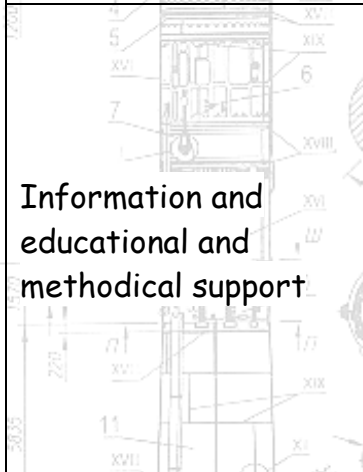
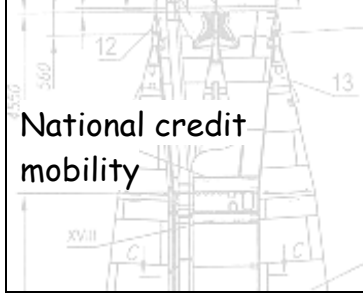

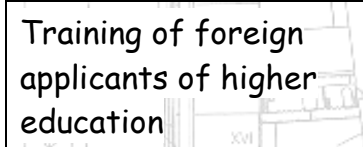


- PRL 9** Ability to determine reasonably the class of materials for aircraft and rocket and space elements.
- PRL 10** Ability to choose modification methods of aircraft and rocket and space elements properties.
- PRL 11** Ability to assess economic efficiency of aircraft and rocket and space elements production.
- PRL 12** Knowledge of principles to set quality parameters of aircraft and rocket and space objects and to provide the quality of objects.
- PRL 13** Ability to apply the requirements of branch and international standard documents to formulate and solve scientific and technical problems in design, production, repairing, assembly, testing and/or certification of aircraft and rocket and space objects and elements at all stages of their life cycle.
- PRL 14** Ability to identify the final parameters to formulate the appearance of rocket and space technology using the skills to assess the stability and controllability of flying vehicles according to existing techniques.
- PRL 15** Ability to organize the solving of complex tasks in professional activity by consequent and qualitative performing of separate stages with the help of team of specialists.
- PRL 16** Ability to calculate stress-strain state, define parameters strength of structural elements and systems reliability of aircraft and rocket and space technology and industrial manufacturing means using modern software applied in the professional area.
- PRL 17** Ability to use practically modern methods, techniques and means of design, production, repairing, assembly, testing and/or certification of aircraft and rocket and space elements for different kinds of industrial production.
- PRL 18** Knowledge of theoretical and instrumental support of residual resource diagnostics of aircraft and rocket and space technology details using modern metrological equipment.
- PRL 19** Ability to formulate and solve scientific and technical tasks dealing with the development of new models using knowledge and understanding of structural features and working processes in aircraft and rocket and space systems and elements.

8 - Resource support for program implementation

Staffing	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 dated 30.12.2015 № 1187 (with changes according to RCMU № 347 dated 10.05.2018).
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 <p>Material and technical support</p>	<p>In accordance with the technological requirements for material and technical support of educational activities of the particular level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (with changes according to RCMU № 347 dated 10.05.2018).</p> <p>Education process is provided with studying areas, required equipment, computers, specialized laboratories, access to information resources.</p> <p>Three computerized laboratories as well as the diagnostic laboratory for common use with Firefly Aerospace Ukraine Company, laboratory of aviation vehicles with military and transport planes, helicopter, units and elements of flying vehicles are at the disposal of students.</p>
 <p>Information and educational 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 dated 30.12.2015 № 1187, (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, Campus of Igor Sikorsky Kyiv Polytechnic Institute, Educational resources of "Sikorsky" platform, departments sites.</p>
<p>9 - Academic Mobility</p>	
 <p>National credit mobility</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>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 +) 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 the education program (academic disciplines, course projects / works, practices)	Number of ECTS credits	Form of final control
Compulsory (regulatory) components of the EP			
General training cycle			
30 1	Intellectual Property and Patent Science.	3	Credit
30 2	Fundamentals of engineering and sustainable development technologies	2	Credit
30 3	Practical course in foreign language business communication	3	Credit
30 4	Management of innovative projects and programs	3	Credit
Professional training cycle			
ПО 1	Design of satellites	5	Exam
ПО 2	Course project in satellite design	1,5	Credit
ПО 3	Means and methods of remote sensing of the earth	4	Exam
ПО 4	Design of launch vehicles and their components	4,5	Exam
ПО 5	Mechanics of destruction and residual resource	4	Credit
ПО 6	Satellite control systems	4	Exam
ПО 7	Scientific Research on Master Thesis Topic	4	Credit
ПО 8	Pre-diploma practice	14	Credit
ПО 9	Preparation and defense of a master's thesis	12	Захист
Selective components of EP			
Professional training cycle			
ПВ 1	Educational component of 1F catalog	4	Credit
ПВ 2	Educational component of 2F catalog	4	Credit
ПВ 3	Educational component of 3F catalog	6	Exam
ПВ 4	Educational component of 4F catalog	6	Exam
ПВ 5	Educational component of 5F catalog	6	Exam
Total amount of obligatory educational components:		64	
The total amount of selective educational components:		26	
TOTAL AMOUNT OF EDUCATION PROGRAM COMPONENTS		90	

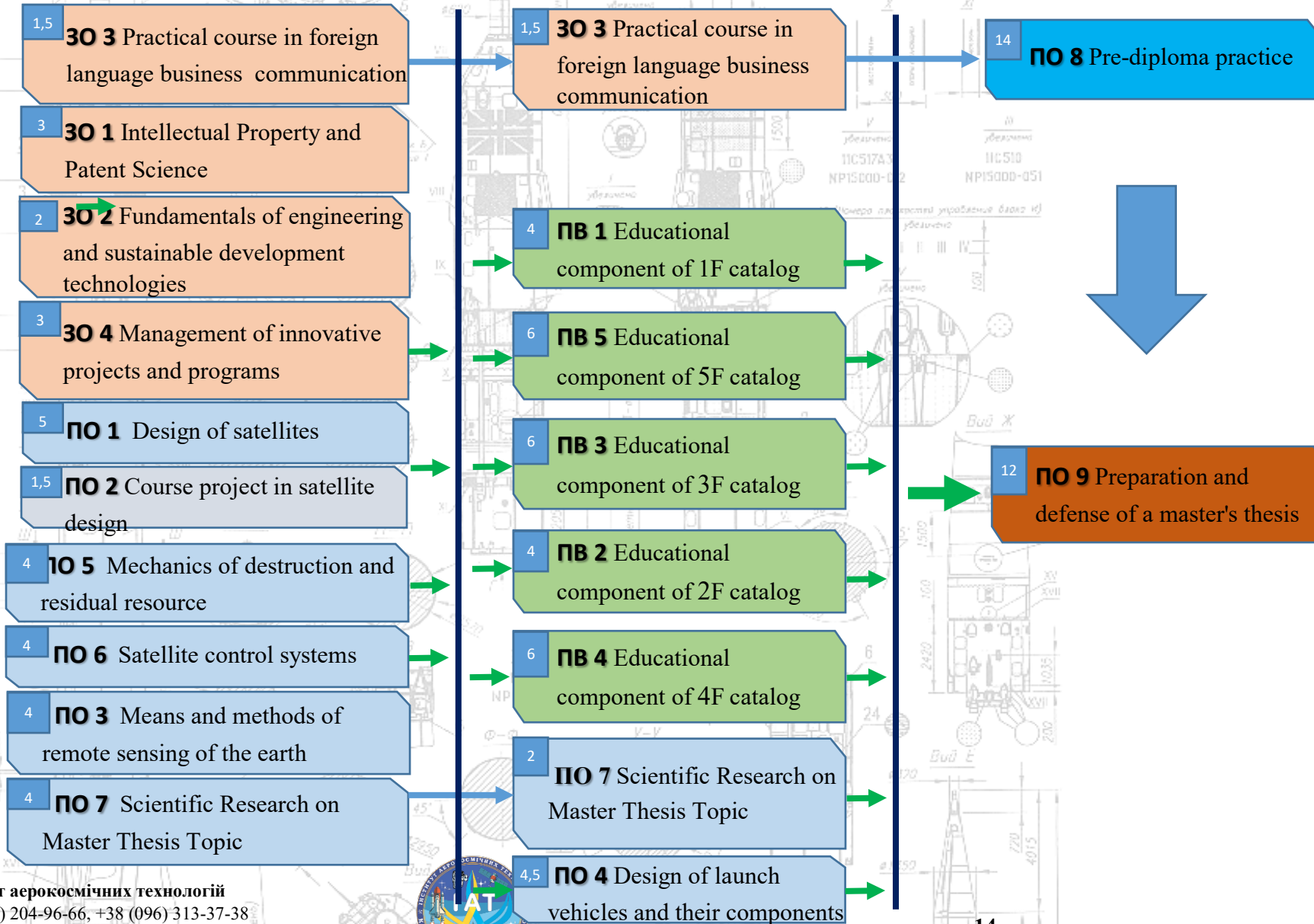


3. Structural and logical scheme of the educational program

I Semester

II Semester

III Semester



4. Form of certification of applicants for higher education

Graduation certification of higher education applicants in the educational program "Aerospace and rocket systems engineering" specialty 134 "Aerospace and rocket-space technology" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document conferred Doctor of Philosophy degree and qualification: Doctor of Philosophy in Aerospace and rocket-space technology. The qualification work is checked for plagiarism and is placed in the repository of the NTB of the University for free access after the defense. Graduation certification is open and public.

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

	3O 1	3O 2	3O 3	3O 4	ПО 1	ПО 2	ПО 3	ПО 4	ПО 5	ПО 6	ПО 7	ПО 8	ПО 9
GC 1		+								+			+
GC 2		+							+		+	+	+
GC 3	+				+	+		+		+		+	+
GC 4		+	+									+	+
GC 5	+						+	+			+		+
GC 6							+				+		
GC 7				+							+		+
GC 8	+								+		+		+
GC 9			+										
GC 10					+	+	+				+		
GC 11				+			+				+	+	
PC 1		+		+					+		+	+	+
PC 2								+	+				+
PC 3				+									+
PC 4				+	+	+		+	+	+			+
PC 5					+	+		+			+		+
PC 6				+				+	+			+	
PC 7							+				+		+
PC 8										+			+
PC 9													+
PC 10					+	+	+	+	+	+			+
PC 11					+	+	+	+	+	+			+



6. Matrix for providing program learning outcomes with relevant components of education program

	3O 1	3O 2	3O 3	3O 4	ПО 1	ПО 2	ПО 3	ПО 4	ПО 5	ПО 6	ПО 7	ПО 8	ПО 9
PRL 1		+			+	+		+	+	+	+	+	+
PRL 2	+										+	+	+
PRL 3							+			+			
PRL 4	+	+		+						+			+
PRL 5		+		+				+					
PRL 6			+							+	+		
PRL 7			+								+		
PRL 8	+			+							+	+	+
PRL 9					+	+		+	+				+
PRL10									+				+
PRL 11				+									+
PRL12				+				+					
PRL13		+					+	+	+		+	+	+
PRL14								+		+			
PRL15		+		+	+	+	+	+	+		+	+	
PRL16								+	+				+
PRL17				+	+	+		+				+	+
PRL18						+			+				+
PRL19	+				+			+		+	+		+

