

**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

**Aerospace and Rocket Systems Engineering**

**EDUCATIONAL AND PROFESSIONAL PROGRAM**

**second (master) level of higher education**

<b>specialty</b>	<b>134 Aerospace and rocket-space technology</b>
<b>field of knowledge</b>	<b>13 Mechanical engineering</b>
<b>qualification</b>	<b>Master in Aerospace and rocket-space technology</b>

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

Kyiv – 2021

## 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

**Petro Yakovenko** chief designer, leader of the design department State Enterprise “Derzh KKB  
“Luch”

**Ihor Luchko** Engineer of organization “AEROPRACT”

### AGREED:

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

Head SMC 134  
(Protocol №2 from 03.12.2021)

**Volodymyr KABANYACHYI**

Methodical Council of Igor Sikorsky Kyiv Polytechnic Institute

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

**Anatolii MELNYCHENKO**

## **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.**

Recommendations of upgrading of education programs (order of Igor Sikorsky Kyiv Polytechnic Institute N HOH 248/2021 dated 22.10.2021 “ Upgrading of education programs of Igor Sikorsky Kyiv Polytechnic Institute”) were considered and the list of compulsory and selective education components was improved.

The results of self-analysis of the 2021 education program were considered.

Recommendations of regulation and specification of multi-credits education components in semesters are considered

The Project of Higher Education Standards of specialty **134** "Aviation and Rocket and Space Systems Engineering" **for the second (master) level was considered.**

The educational 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 № 4/21 from 24.11.2021).

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# 1. Profile of the educational program

<b>1 – General information</b>	
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
The official name of the EP	Aviation and Rocket and Space Systems Engineering
Type of diploma and scope of EP	Master Diploma, single, 90 ECTS credits, training period 1 year and 4 months
Availability of accreditation	EP accreditation certificate -1027, valid till 01.07.2026
Cycle / level of HE	NQF of Ukraine – level 7 QF-EHEA – the second cycle EQF-LLL – level 7
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	<a href="https://osvita.kpi.ua/op">https://osvita.kpi.ua/op</a> , <a href="http://iat.kpi.ua">http://iat.kpi.ua</a>
<b>2 – The purpose of the educational program</b>	
<p>The purpose of the educational program is to train specialists who able to solve difficult specialized and practical problems in the area of aerospace and rocket-space technology and carry out innovative professional activity.</p> <p>The purpose of the educational program corresponds the development strategy of Igor Sikorsky Kyiv Polytechnic Institute for the period 2020-2025 and it is based on the vision and mission Igor Sikorsky Kyiv Polytechnic Institute</p> <p><b>Vision</b> 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.</p> <p><b>Mission</b> 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.</p>	
<b>3 – Characteristics of the educational program</b>	
Subject area	<p><b>Objects of study</b> - 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.</p> <p><b>Objectives of study</b> are to train specialists who can solve complicated problems in the professional area dealing with the design and development and (or) certification of aviation and rocket and space technique, engines and power plants, structures and systems or to solve problems concerning the research performing and (or) carrying out innovations and characterized by the uncertainty of conditions and requirements in the process of training.</p>

	<p><b>Theoretical content of the subject area</b> – physical processes models in aerospace and rocket-space objects, modern concepts of solid body deformation mechanics, aero- and gas dynamics, thermophysics and electrical engineering.</p> <p><b>Methods, techniques and technologies</b> - 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 aerospace and rocket-space objects.</p> <p><b>Tools and equipment</b> - 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.</p>
Orientation of the EP	Educational and professional
The main focus of EP	<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: computer technology for system and process modeling, work with data bases, composite materials, technical objects diagnostic and control.</p> <p>Great attention is paid to the development of rocket-space vehicles structures, airspace engineering.</p> <p>Key words: rockets, space vehicles, airspace engineering</p>
Features of EP	<p>Studying is conducted using the elements of dual education.</p> <p>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.</p> <p>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.</p>
<b>4 – Suitability of graduates for employment and further study</b>	
Suitability for employment	<p>SC 003:2010, Codes:</p> <p>2145. Professionals in the field of Mechanical Engineering</p> <p>2145.1 Junior Research Fellow (Engineering mechanics)</p> <p>2145.2 Engineer- designer (mechanics)</p>
Further training	Continuing study at the third (educational and scientific) level of higher education and / or obtaining additional qualifications in adult education system.
<b>5 – Teaching and assessment</b>	
Teaching and learning	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 forms 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 the Igor Sikorsky Kyiv Polytechnic Institute including all forms of study.

<b>6 – Program competencies</b>	
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.
<b>General Competences (GC)</b>	
<p>GC 1. Ability to abstract thinking, analysis and synthesis.</p> <p>GC 2. Ability to identify, formulate and solve problems</p> <p>GC 3. Ability to carry out researches on the particular level.</p> <p>GC 4. Ability to generate new ideas.</p> <p>GC 5. Ability to use modern information technology.</p> <p>GC 6. Ability to adapt and work in new environment.</p> <p>GC 7. Ability to be careful and laborious to the tasks and responsibilities.</p> <p>GC 8. Ability to study and obtain modern knowledge.</p> <p>GC 9. Ability to use knowledge on practice.</p> <p>GC 10. Ability to solve complicated tasks in the professional activity.</p> <p>GC 11. Ability to implement new ideas in the form of innovation solutions, working in a team with the representative from other professional spheres.</p> <p>GC 12. Ability to further autonomous and self-directed study on the basis of new scientific and technical achievements.</p> <p>GC 13. Ability to communicate foreign language in the professional (scientific and research) activity.</p>	
<b>Professional competencies (PC)</b>	
<p>PC 1. Ability to know history, current state, problems and development trends of aircraft and rocket and space technology.</p> <p>PC 2. Ability to think critically of problems of aviation and space and rocket engineering considering similar subjects, engineering sciences, physics, chemistry, ecology and economics.</p> <p>PC 3. Ability to choose the optimal materials for the construction elements of aircraft and rocket and space technology.</p> <p>PC 4. Ability to evaluate technical and economic efficiency of the design, researches, technological processes, and innovations.</p> <p>PC 5. Ability to create, improve and use mathematical and numerical modeling methods of properties, phenomena and processes in the systems and elements of aircraft and rocket and space technology.</p> <p>PC 6. Ability to state and solve professional problems by means of base knowledge in hydraulic, pneumatic, electrical and electronic systems</p> <p>PC 7. Ability to conduct engineering and managing work dealing with production preparation of aircraft and rocket and space objects using new technologies.</p> <p>PC 8. Ability to describe the models of working processes of aircraft and rocket and space technology systems and elements required to understand, describe, and improve aircraft and rocket and space objects and to optimize their parameters.</p> <p>PC 9. Ability to state and solve professional tasks on the basis of basic knowledge in the field of hydraulic, pneumatic, electric and electronic systems.</p> <p>PC 10. Ability to implement physical and mathematical models of systems and processes by means of modern information technology methods</p> <p>PC 11. Ability to develop the control systems of flying vehicles</p> <p>PC 12. Ability to design and test elements and units of aircraft and rocket and space vehicles</p> <p>PC 13. Ability to design and use modern systems of aircraft and space objects</p> <p>PC 14. Ability to optimize gas dynamics parameters of flying vehicles and rocket engines.</p>	

## 7 – Program results of learning

- PRL 1. Ability to know and understand basics of fundamental and engineering sciences that are the basis for aircraft and/or rocket and space technology
- PRL 2. Ability to know and understand the working processes in the systems and units of aircraft and/or rocket and space technology necessary to describe, improve and optimize their parameters.
- PRL 3. To understand and use the methods of system analysis at solving complex professional (scientific and research) tasks.
- PRL 4. Ability to use modern methods of solving inventive tasks, to protect intellectual property of technical solutions and other results of professional (scientific and research) activity.  
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 5. Ability to use new specialized software to solve complex problems in professional (scientific and technical) activity according to educational program.
- PRL 6. 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 7. Skills of self-directed and teamwork, to be a leader, to organize the work considering the deadline and showing professional responsibility.
- PRL 8. 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 9. Ability to determine reasonably the class of materials for aircraft and rocket and space elements, to choose and use methods of modifications their properties.
- PRL 10. Ability to calculate economic effectiveness of production of elements and systems of aircraft and/or rocket and space technology
- PRL 11. Ability to identify the qualitative parameters to the objects of aircraft and/or rocket and space technology.
- PRL 12. 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 13. 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 14. Ability to organize the performing of complex professional tasks by the team.
- PRL 15. Ability to use modern methods and means of design and technological production, as well as computer production, assembly and testing of elements and systems of modern aircraft and rocket and space technology.
- 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. Ability to identify and optimize the technological processes parameters using CAD for production of units, systems of aircraft and rocket and space technology.
- PRL 19. 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 20. 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 21. Knowledge of foreign language allowing communicating in professional environment and using of scientific and technical documentation in the subject area.



PRL 22. 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 23. Ability to choose modification methods of aircraft and rocket and space elements properties.

PRL 24. Knowledge of principles to set quality parameters of aircraft and rocket and space objects and to provide the quality of objects.

PRL 25. Knowledge of theoretical and instrumental support of residual resource diagnostics of aircraft and rocket and space technology details using modern metrological equipment.

PRL 26. 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 educational activities for the particular level of higher education approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current version. The education process is provided by the teaching staff of the department of space engineering: 3 professors, Doctor of Sciences; 4 assistant professors. PhD; 1 senior teacher; 1 assistant.
Material and technical support	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 in the current version. Educational process is provided with studying areas, required equipment, computers, specialized laboratories, and access to information resources. 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.
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational 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 in the current version. Applicants of higher education use information resources and educational environment of KPI library, Campus of Igor Sikorsky Kyiv Polytechnic Institute, Educational resources of “Sikorsky” platform, departments sites.

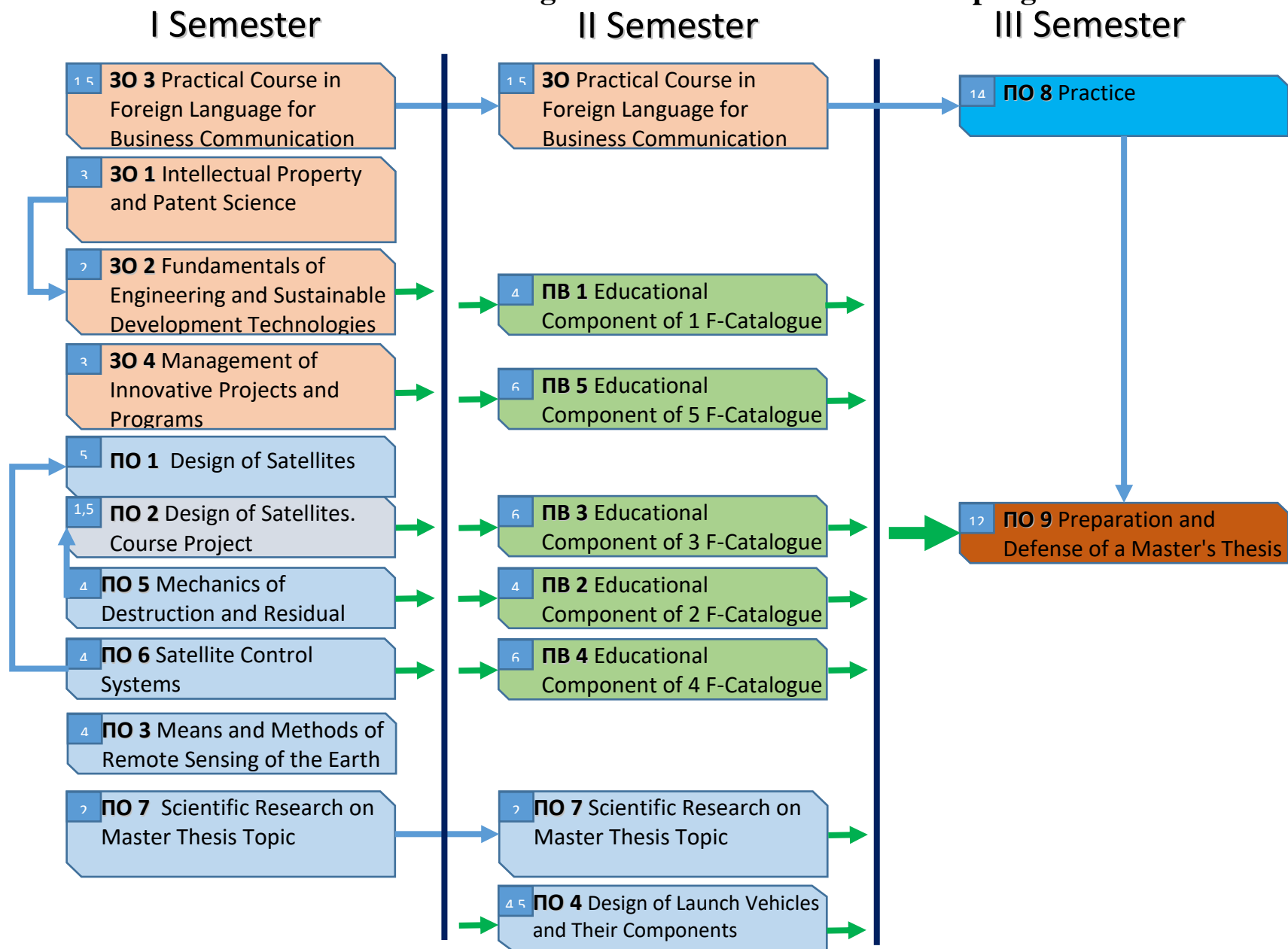
### **9 – Academic Mobility**

National credit mobility	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. Agreement on academic mobility is signed with Dnipro National University
International credit mobility	Students take part in the programs of academic mobility (Erasmus +) with the University of the Basque Country (Spain), Warsaw University of Technology (Poland), ENS Lyon (France).
Training of foreign applicants of higher education	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.

## 2. List of components of the educational program

Code	Components of the educational program (academic disciplines, course projects / works, practices)	Number of ECTS credits	Form final control
<b>Obligatory (regulatory) components of the EP</b>			
<b>General training cycle</b>			
<b>3O 1</b>	Intellectual Property and Patent Science	3	Test
<b>3O 2</b>	Fundamentals of Engineering and Sustainable Development Technologies	2	Test
<b>3O 3</b>	Practical Course in Foreign Language for Business Communication	3	Test
<b>3O 4</b>	Management of Innovative Projects and Programs	3	Test
<b>Professional training cycle</b>			
<b>ΠO 1</b>	Design of Satellites	5	Exam
<b>ΠO 2</b>	Design of Satellites. Course Project	1,5	Test
<b>ΠO 3</b>	Means and Methods of Remote Sensing of the Earth	4	Exam
<b>ΠO 4</b>	Design of Launch Vehicles and Their Components	4,5	Exam
<b>ΠO 5</b>	Mechanics of Destruction and Residual Resource	4	Test
<b>ΠO 6</b>	Satellite Control Systems	4	Exam
<b>ΠO 7.1</b>	Scientific Research on Master Thesis Topic. Part 1. Fundamentals of scientific research	2	Test
<b>ΠO 7.2</b>	Scientific Research on Master Thesis Topic. Part 2. Scientific Research on Master Thesis Topic	2	Test
<b>ΠO 8</b>	Practice	14	Test
<b>ΠO 9</b>	Preparation and Defense of a Master's Thesis	12	Defense
<b>Selective components of EP</b>			
<b>Professional training cycle</b>			
<b>ΠB 1</b>	Educational Component of 1 F-Catalogue	4	Test
<b>ΠB 2</b>	Educational Component of 2 F-Catalogue	4	Test
<b>ΠB 3</b>	Educational Component of 3 F-Catalogue	6	Exam
<b>ΠB 4</b>	Educational Component of 4 F-Catalogue	6	Exam
<b>ΠB 5</b>	Educational Component of 5 F-Catalogue	6	Test
<b>Total amount of obligatory educational components:</b>		<b>64</b>	
<b>The total amount of selective educational components:</b>		<b>26</b>	
<b>TOTAL VOLUME OF THE EDUCATIONAL COMPONENT PROGRAM</b>		<b>90</b>	

### 3. Structural and logical scheme of the educational program



#### 4. Form of certification of applicants for higher education

Assessment 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 Master degree and qualification: Master 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. Assessment is open and public.

#### 5. Matrix of program competences correspondence to the components of the educational program

	3O 1	3O 2	3O 3	3O 4	ΠO 1	ΠO 2	ΠO 3	ΠO 4	ΠO 5	ΠO 6	ΠO 7	ΠO 8	ΠO 9
3K 1		+								+			+
3K 2		+							+		+	+	+
3K 3	+				+	+		+		+		+	+
3K 4		+	+									+	+
3K 5	+						+	+			+		+
3K 6							+				+		
3K 7				+							+		+
3K 8	+								+		+		+
3K 9			+										
3K 10					+	+	+				+		
3K 11				+				+			+	+	
ΦK 1		+		+					+		+	+	+
ΦK 2								+	+				+
ΦK 3				+									+
ΦK 4					+	+		+	+	+			+
ΦK 5					+	+		+			+		+
ΦK 6				+				+	+			+	
ΦK 7							+				+		+
ΦK 8										+			+
ΦK 9									+				+
ΦK 10					+	+	+	+					+
ΦK 11					+	+							+

## 6. Matrix for providing program learning outcomes with relevant components of the educational 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
ПРН 1		+			+	+		+	+	+	+	+	+
ПРН 2	+										+	+	+
ПРН 3							+			+		+	
ПРН 4	+	+		+							+		+
ПРН 5		+		+				+					
ПРН 6			+							+	+		
ПРН 7			+								+		
ПРН 8	+			+							+	+	+
ПРН 9					+	+		+	+				+
ПРН10									+				+
ПРН 11				+									+
ПРН12				+				+					
ПРН13		+					+	+	+		+	+	+
ПРН14								+		+			
ПРН15		+		+	+	+	+	+			+	+	
ПРН16								+	+				+
ПРН17				+	+	+		+				+	+
ПРН18						+			+				+
ПРН19	+				+			+		+	+		+