

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
National Aerospace University named after N.Ye. Zhukovsky
“Kharkiv Aviation Institute”

APPROVED

By Academic Council
of National Aerospace University
named after N.Ye. Zhukovsky
“Kharkiv Aviation Institute”
December 22, 2020, protocol № 5
order № 538, December 23, 2020

EDUCATIONAL AND PROFESSIONAL PROGRAM

Design, Operational Diagnostics, Maintenance and Repair of Aircraft Engines and
Power Plants

Level of higher education – first (bachelor)

with Speciality 134 Aerospace Engineering

in Field 13 Mechanical Engineering

Qualification: Bachelor in Aerospace Engineering

in Field Mechanical Engineering

(with changes made in accordance with the decision
of the Scientific Council of Khai, protocol № 9 of April 28, 2021)

Enacted from
«01» September, 2021

Rector of National Aerospace
University named after
N.Ye. Zhukovsky
“Kharkiv Aviation Institute”
_____ M. Nechyporuk
order № 178, April 29, 2021

PREFACE

Educational and professional program " Design, Operational Diagnostics, Maintenance and Repair of Aircraft Engines and Power Plants " in the specialty 134 "Aviation and rocket and space technology" for the preparation of bachelors developed by the working group of the National Aerospace University named after N.E. Zhukovsky "Kharkiv Aviation Institute" consisting of:

Project group:

- | | | | |
|---|--------------------------------------|----------------------|--|
| 1 | Guarantor of the educational program | Bezugliy S. V. | – Cand. tech. Sciences, Associate Professor, Associate Professor of the Department of Aircraft Engine Design |
| 2 | Project members: | team Garkusha O. I. | – Cand. tech. Sciences, Associate Professor, Associate Professor of the Department of Aircraft Engine Design |
| 3 | Project members: | team Zelenskii R. L. | – Cand. tech. Sciences, Associate Professor of the Department of Aircraft Engine Design |
| 4 | | Xie Yuchi | - student. of the Department of Aircraft Engine Design |

Рецензії та відгуки зовнішніх стейкхолдерів (За наявності)

- 1.
- 2.
- 3.

INTRODUCTION

According to Art. 1 "Basic terms and their definitions" of the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII (as amended) educational program - a system of educational components at the appropriate level of higher education within the specialty that determines the requirements for the level of education persons who can start studying under this program, the list of disciplines and the logical sequence of their study, the number of ECTS credits required to implement this program, as well as the expected learning outcomes (competencies) that must be mastered by the applicant.

The educational program is used during:

- accreditation of the educational program, inspection of educational activity by specialty and specialization;
- Development of curriculum, programs of academic disciplines and practices;
- Development of diagnostic tools for the quality of higher education;
- Determination of the content of education in the system of retraining and advanced training;
- Professional orientation of applicants for the profession.

The educational and professional program takes into account the requirements of the Law of Ukraine "On Higher Education" dated 01.07.2014 № 1556-VII (as amended), the Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341 and establishes:

- volume and term of study of bachelors;
- general competencies;
- professional competencies;
- Program learning outcomes;
- list and scope of academic disciplines for mastering the competencies of the educational-professional program;
- requirements for the structure of academic disciplines.

Educational and professional program is used for:

- drawing up curricula and working curricula;
- formation of individual plans of students;
- formation of working programs of educational disciplines, practices;
- Determination of information base for the formation of diagnostic tools;
- accreditation of educational and professional program;
- internal and external quality control of training;
- Certification of bachelors in the educational-professional program "Operational diagnostics, maintenance and repair of aircraft engines and EU" in the specialty 134 "Aviation and rocket and space technology".

Users of the educational and professional program:

- applicants for higher education studying at the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute";
- Scientific and pedagogical staff who train bachelors in the educational-professional program "Operational diagnostics, maintenance and repair of aircraft engines and EU" in the specialty 134 "Aviation and rocket and space technology" of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute";
- Examination commission of specialty 134 "Aviation and rocket and space technology";
- Admissions Committee of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute".

The educational and professional program extends to the departments of the University involved in the training of bachelor's degree in the educational and professional program " Design, Operational Diagnostics, Maintenance and Repair of Aircraft Engines and Power Plants " in the specialty 134 " Aerospace Engineering " .

1. REGULATORY REFERENCES

The educational and professional program is developed on the basis of the following regulations and recommendations:

1. Law of Ukraine "On Higher Education". № 1556-UII dated 01.07.2014 (as amended). Law of Ukraine "On Higher Education". № 1556-UII dated 01.07.2014 (as amended).
2. Resolution of the Cabinet of Ministers of Ukraine "On approval of the National Qualifications Framework" dated 23.11.2011 № 1341.
3. Resolution of the Cabinet of Ministers of Ukraine "On approval of the list of branches of knowledge and specialties for which the training of applicants for higher education" from 29.04.2015 № 266.
4. Resolution of the Cabinet of Ministers of Ukraine "On approval of the Regulations on the procedure for exercising the right to academic mobility" dated 12.08.2015 № 579.
5. National Classifier of Ukraine. Classifier of professions DK 003: 2010, approved by the order of Derzhspozhyvstandart of Ukraine dated 28.07.2010 № 327 (as amended).
6. Methodical recommendations for the development of higher education standards, approved by the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine, protocol of March 29, 2016 № 3.
7. Regulations "On the organization of the educational process" SUYA KHAI-NOV-P / 005: 2016 of the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute", approved by the Academic Council of the University on 18.05.2016, protocol № 10.
8. A Tuning Guide to Formulating Degree Programme Profiles Including Programme Competences and Programme Learning Outcomes. -Bilbao, Groningen and The Hague, 2010.
9. A TUNING-AHELO conceptual framework of expected/desired learning outcomes in engineering. OECD Education Working Papers, No. 60, OECD Publishing 2011. <http://dx.doi.org/10.1787/5kghtchn8mbn-en>.
10. Development of educational programs. Methodical recommendations / Author. : VM Zakharchenko, VI Lugovyi, Yu. M. Rashkevich, Zh. V. Talanova / Ed. VG Kremenyа. - K.:SE "Priorities", 2014. - 120 p.
11. Order of the Ministry of Education and Science of Ukraine "On the peculiarities of the introduction of the list of branches of knowledge and specialties for which higher education is approved, approved by the Cabinet of Ministers of Ukraine dated April 29, 2015 № 266" dated 06.11.2015 № 1151.
12. Classification of types of economic activity: DK 009: 2010. - Valid from 01.01.2012. - (National Classifier of Ukraine).
13. Classifier of professions: DK 003: 2010. - Valid from 01.11.2010. - (National Classifier of Ukraine).
14. National educational glossary: higher education / 2nd ed., Revised. And extra. /Author-compiler: VM Zakharchenko, SA Kalashnikov, VI Lugovyi, AV Stavytsky, Yu. M. Rashkevich, Zh. V. Talanova / Ed. VG Kremenyа. - Kyiv: Pleiades Publishing House LLC, 2014. - 100 p.

2. PROFILE OF THE EDUCATIONAL PROFESSIONAL PROGRAM " DESIGN, OPERATING DIAGNOSTICS", MAINTENANCE AND REPAIR OF AEROSPACE ENGINEERING

1 – Загальна інформація	
Full name of the higher educational institution and structural subdivision	National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" Department of Aircraft Engine Design
Degree of higher education and title of qualification in the original language	Degree of higher education - bachelor Field of Study <u>13 Mechanical Engineering</u> Program Subject Area <u>134 Aerospace Engineering</u>
The official name of the educational and professional program	Design, Operational Diagnostics, Maintenance and Repair of Aircraft Engines and Power Plants
Type of diploma and scope of educational and professional program	Bachelor's degree, single degree, 240 ECT credits, term of study 3 years 10 months
Availability of accreditation	Certificate of accreditation: Series YD № 21001693, issued on 20.02.2018 by the order of the Ministry of Education and Science of Ukraine dated 19.12.2016 № 1565 Valid 01.07. 2024. Accreditation period: 10 years (repeated accreditation in 2024)
Cycle / level	NRC of Ukraine - level 6, FQ-EHEA - first cycle, EQF-LLL-level 6.
Prerequisites	Complete secondary education
Language (s) of instruction	The language of instruction is English
Validity of the educational and professional program	Before the introduction of a new educational program
Internet address of the permanent placement of the description of the educational-professional program	https://khai.edu/ua/education/osvitni-programi-i-komponenti/osvitni-programi-bakalavriv/
2 - The purpose of the educational program	
<p>Training of highly qualified specialists (bachelors) in field of Mechanical Engineering, To provide theoretical knowledge and practical skills sufficient for successful performance of professional duties under the educational-professional program "Design, Operational diagnostics, maintenance and repair of aircraft engines and EU" in the specialty 134 "Aerospace Engineering".</p> <p>Formation of the personality of a specialist able to use professional knowledge and practical skills to solve complex specialized problems and practical problems of technical maintenance and repair of aircraft engines used in aviation and rocket and space technology.</p>	
3 – Characteristics of the educational program	
Objective area	Object of studying – phenomena and problems that are related with stages of life cycle of aerospace engineering; aircraft gas turbine and piston engines, working process, design, theoretical bases and engineering methods of analysis, systems and accessories, loads that affect the parts, analysis of strength, rigidity, stability, durability, oscillations and service life of the engine parts, as a base of their faultless operation in the specified period of maintenance; systems of maintenance; structural materials that are used in engines.

	<p>Goal of studying – human resource development that are able for solving the tasks of designing, development, manufacturing and certification of aerospace engineering objects, engines and power plants, designs and systems; complex of knowledge and skills forming in the professional area using fundamental and special applied methods of designing, numerical analysis of aircraft engines and their systems, modern methods of diagnostics and health management, bases of aircraft engines maintenance.</p> <p>Theoretical sense of the applied area: theoretical bases of designing, maintenance diagnostics, engineering management, and repairing of aircraft engines, development and manufacturing of objects and technologies of aerospace engineering.</p> <p>Methods and technologies: analytical, numerical, and experimental researches of the object area, in part integrated computer technologies, which are related with stages of a life cycle of aerospace engineering, modern software for designing and numerical analysis of engines and their systems, scheduling of the engine designing and testing; technologies of manufacturing and maintenance service, quality ensuring.</p> <p>Instruments and equipment: laboratory equipment with measuring tools, in part hydraulic testbeds, aerodynamic tunnels, equipment for researching materials properties and stress-strain state of structures; instruments and equipment for studying design and structure of aircraft, helicopters, rocket engineering, engines and power plants; equipment that is used for manufacturing, assembling, and testing; computers with information and specialized software, in part systems of computer analysis, geometrical modelling, finite element analysis, integrated designing and manufacturing of aerospace engineering objects, engineering tools for education, laboratory equipment, prepared mockups of engines and aggregates.</p>
Orientation of the educational program	Educational and professional bachelor's program
The main focus of the educational-professional program (specialization)	<p>General education in mechanical engineering on specialty aerospace engineering.</p> <p>The program contains educational disciplines of general and professional studying of integral character, mandatory educational disciplines and disciplines of free choice for ensuring professional education: modern methods of designing that include theoretical calculations, structural arrangement analysis, technological methods, etc. The ability to use modern application packages, structural and object-oriented approaches to independent creative work and a system of expert decision support are developed</p>
Features of the program	<p>The program provides study of the theoretical foundations of aircraft engine construction, acquisition of relevant knowledge and competencies in classical and modern achievements in the field of design, production and operation of aircraft engines, deep knowledge of models, methods and algorithms of calculations related to design and development of aircraft engines. also technologies of their production and operation. Specialists are trained who are able to apply the acquired knowledge of mathematical foundations, principles of modeling of gas-dynamic and strength processes, algorithmic principles in design, development of technical systems, perform comparative analysis of engine designs and their systems. The ability to use modern application packages, structural and object-oriented approaches to independent creative work and a system of expert decision support are developed.</p>

4 - Suitability of graduates for employment and further study	
Suitability for employment	Graduates can work: at the enterprises-developers, the enterprises-manufacturers of aviation equipment, the enterprises on service of aviation equipment; in design and engineering, research, production and special industry institutions for the development, manufacture of aircraft and its components.
Further training	It is possible to continue education at the second (master's) level of higher education.
5 – Teaching and assessment	
Teaching and learning	Student-centered learning, self-study, problem-oriented learning aimed at the development of critical and creative thinking, learning through laboratory practice, dual, distance education and more. Lectures, multimedia lectures, laboratory work, seminars, practical classes in small groups, independent work based on textbooks and abstracts, consultations with teachers, preparation of bachelor's thesis.
Evaluation	Written exams, practice reports, essays, presentations, current (modular) control, project (bachelor's) work and its defense.
6 – Program Components	
Integral competence	Ability to solve complex specialized and practical problems related to the development, production and certification of Aerospace Engineering, which involves the application of theories and methods of physics, mathematics and engineering, and is characterized by complexity and uncertainty.
General competencies (GC)	GC 1. Ability to communicate in the state language both orally and in writing. GC 2. Ability to communicate in a foreign language. GC 3. Skills for safe activities, the desire to preserve the environment GC 4. Skills in the use of information and communication technologies. GC 5. Ability to work both independently and in a team with representatives of other professional groups. GC 6. Ability to generate new ideas (creativity). GC 7. Ability to make informed decisions in normal and special situations and implement them correctly. GC 8. Ability to learn and master modern knowledge. GC 9. The ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms and Ukraine. GC 10. Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technology, use different types and forms of motor activities for recreation and a healthy lifestyle. GC 11. Knowledge and understanding of the subject area and understanding of the features of the profession. GC 12. The ability to think abstractly, concretely and generalized, to analyze and synthesize.
Special (professional) competences (SC)	SC1. Ability to use theories of flight dynamics and control in the design of aircraft and rocket and space technology. SC2. Ability to use the positions of hydraulics, aero- and gas dynamics to describe the interaction of bodies with the gaseous and hydraulic environment. SC3. Ability to assign optimal materials for structural elements of aircraft and rocket and space technology. SC4. Ability to calculate the elements of aerospace and rocket and space technology for strength.

	<p>SC5. Ability to design and test elements of aerospace and rocketry, its equipment, systems and subsystems.</p> <p>SC6. Ability to develop and implement technological processes of production and maintenance of elements and objects of aviation and rocket and space technology.</p> <p>SC7. Skills in the use of information and communication technologies and specialized software in teaching and professional activities.</p> <p>SC8. Ability to take into account economic and managerial aspects of the production of elements and objects of aviation and rocket and space technology in professional activities.</p> <p>SC9. Possession of the basics of operation and maintenance of aircraft, engines and their systems.</p> <p>SC10. Ability to develop measures to diagnose and eliminate malfunctions and failures of engine systems, to analyze the causes of their occurrence, to develop and implement measures to prevent them.</p> <p>SC11. Ability to perform official duties in accordance with applicable regulations based on knowledge of aviation technology and the influence of the human factor.</p>
<p>7 - Program learning outcomes (PLO)</p>	
	<p>PLO1. To communicate freely orally and in writing in state and foreign languages on professional issues.</p> <p>PLO2. Understand environmentally hazardous and harmful factors of professional activity and adjust its content in order to prevent negative impact on the environment.</p> <p>PLO3. Have the means of modern information and communication technologies to the extent sufficient for training and professional activities.</p> <p>PLO4. Explain their decisions and the basis for their adoption to specialists and non-specialists in a clear and unambiguous form.</p> <p>PLO5. Have the skills of self-study and autonomous work to improve professional skills and solve problems in a new or unfamiliar environment.</p> <p>PLO6. To form substantiated assessments of the actions of state bodies and other political institutions from the standpoint of universal, democratic values, the priority of human and civil rights and freedoms.</p> <p>PLO7. Have the logic and methodology of scientific knowledge, based on an understanding of the current state and methodology of the subject area.</p> <p>PLO8. Comply with the requirements of industry regulations on the procedures for design, manufacture, testing, operation and (or) certification of elements and objects of aerospace and rocket technology at all stages of their life cycle.</p> <p>PLO9. Explain the influence of design parameters of elements of aviation and rocket and space technology on its flight characteristics. Have an idea of the methods of ensuring the stability and controllability of aviation and rocket and space technology.</p> <p>PLO10. Have the skills to determine the loads on the structural elements of aviation and space technology at all stages of its life cycle.</p> <p>PLO11. Understand the principles of fluid and gas mechanics, in particular, hydraulics, aerodynamics (gas dynamics).</p> <p>PLO12. Describe the structure of metals and nonmetals and know the methods of modifying their properties. Assign optimal materials for elements and systems of aerospace and rocket technology, taking into account their structure, physical, mechanical, chemical and operational properties, as well as economic factors.</p> <p>PLO13. Understand the features of work processes in hydraulic, pneumatic, electrical and electronic systems used in aerospace and rocketry.</p> <p>PLO14. Describe experimental methods for studying the structural, physical-mechanical and technological properties of materials and structures.</p> <p>PLO15. Apply in professional activities modern methods of design, construction and production of elements and systems of aviation and space technology.</p> <p>PLO16. Calculate the stress-strain state, determine the ineffectiveness of structural elements and the reliability of aerospace and rocket systems.</p> <p>PLO17. Understand and justify the sequence of design, manufacture, testing, operation and (or) certification of elements and systems of aerospace and rocketry.</p>

	<p>PLO18. Understand the structure and principles of operation of onboard and navigation equipment of aviation and space technology.</p> <p>PLO19. Understand and justify the design features and basic aspects of work processes in systems and elements of aerospace and rocket technology.</p> <p>PLO20. Understand the theoretical principles and practical methods of instrumental interchangeability of parts of aerospace and rocket technology.</p> <p>PLO21. Have the skills to develop technological processes, including the use of automated computer-aided design of the production of structural elements and systems of aerospace and rocketry.</p> <p>PLO22. Assess the economic efficiency of production of elements and systems of aviation rocket and space technology.</p> <p>PLO23. Understand how operational factors affect the design of aircraft, engines and their systems.</p> <p>PLO24. Have basic knowledge of the organization of maintenance and repair of aircraft.</p> <p>PLO25. Have a basic knowledge of methods and tools for diagnosing aircraft, engines and their systems.</p> <p>PLO26. Have basic knowledge to ensure compliance of aircraft with the requirements of regulatory and technical documentation and standards of airworthiness and flight safety.</p>
<p>8 - Resource support for program implementation</p>	
<p>Staffing</p>	<p>Meets the personnel requirements to ensure the implementation of educational activities in the field of higher education in accordance with current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for educational activities of educational institutions" of December 30, 2015 № 1187, Annex 8).</p> <p>The staff is formed mainly from the scientific-educational staff of the Aircraft Engine Design department. The teachers of professional-oriented disciplines have scientific degrees and academic ranks and meet the license requirements. Professors of another 12 departments of National Aerospace university are also involved in the educational process.</p>
<p>Logistics support</p>	<p>Meets the material and technical requirements to ensure the implementation of educational activities in the field of higher education in accordance with current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for educational activities of educational institutions" of December 30, 2015 № 1187, Annex 9).</p> <p>Training is carried out in the laboratory of gas turbine engines, computer classes; course and diploma design laboratories; laboratories of aircraft engine dynamics; laboratories of gas turbine engines and laboratories of aircraft engine units. Computer classes, projection equipment and visual aids are used, as well as modern system, application and computer programs.</p>
<p>Information and educational and methodical support</p>	<p>Meets the informational and educational-methodological requirements for ensuring the implementation of educational activities in the field of higher education in accordance with the current legislation of Ukraine (Resolution of the Cabinet of Ministers of Ukraine "On approval of licensing conditions for the implementation of educational activities of educational institutions dated December 30, 2015 No. 1187, appendices 10-11) with changes). Includes library resources, electronic educational resources, the website of the National Aerospace University "Kharkiv Aviation Institute" and the website of the Department of Aircraft Engine Design, which contain basic information about educational activities under the EPP; also the library's website and MENTOR system. The use of the virtual learning environment of the National Aerospace University "Kharkiv Aviation Institute" and author's developments of the teaching staff of the Department of Aircraft Engine Design.</p> <p>Methodical manuals and lecture notes of the fund of the methodical office of the department of Aircraft Engine Design, which are also posted in electronic form on the website of the department (website address: https://khai-k203.tilda.ws).</p>

9 - Academic mobility	
National credit mobility	Based on bilateral agreements between the National Aerospace University. N.E. Zhukovsky "Kharkiv Aviation Institute" and technical institutions of Ukraine.
International credit mobility	Based on bilateral agreements between the National Aerospace University. ME Zhukovsky "Kharkiv Aviation Institute" and educational institutions of partner countries.
Training of foreign applicants for higher education	Education of foreign citizens is carried out in the state or English languages. If the education is conducted in the state language, then in certain cases it may be decided to teach one or more disciplines in English and / or other foreign languages, while ensuring the knowledge of students of the discipline in the state language.

3.LIST OF COMPONENTS OF THE EDUCATIONAL PROFESSIONAL PROGRAM (EPP) AND THEIR LOGICAL SEQUENCE

3.1. List of components

EPP code	Components of the educational program (academic disciplines, course projects (works), practices, qualification work)	Number of credits	Form of final control
1	2	3	4
Mandatory components (MC)			
MC1	Geometric Simulation and Graphical Information Technologies (Геометричне моделювання та графічні інформаційні технології)	10	Exam 1, 2
MC2	Introduction to the Major (Вступ до фаху)	4,5	Assessment 1
MC3	Linear Algebra and Analytic Geometry (Лінійна алгебра та аналітична геометрія)	5	Exam 1
MC4	Programming and Digital Computing Methods (Методи програмування та комп'ютерні методи обчислень)	5	Exam 1
MC5	Mathematical Analysis (Математичний аналіз)	10	Exam 2,3
MC6	Materials Science (Матеріалознавство)	5,5	Exam 2
MC7	Theoretical Mechanics and Theory of Machines and Mechanisms (Теоретична механіка та Теорія машин і механізмів)	10	Exam 2,3
MC8	Physics (Фізика)	10	Exam 2,3
MC9	Practice (Graphical Information Technologies) Практика (графічні інформаційні технології)	3	Assessment 2
MC10	Interchangeability and Standardization (Взаємозамінність та стандартизація)	5	Exam 3
MC11	Mechanics of Materials and Structures (Механіка матеріалів і конструкцій)	10	Exam 3,4
MC12	Technology of Structural Materials (Технології конструкційних матеріалів)	6,5	Assessment 3 Exam 5
MC13	Theoretical Mechanics and Theory of Machines and Mechanisms (Term Paper) (Теоретична механіка та Теорія машин і механізмів (КП))	2	def. Assessment 4
MC14	General Arrangement of Aircraft Engines and Power Plants (Загальний устрій авіаційних двигунів та енергетичних установок)	5,5	Exam 4
MC15	Enginetrng Thermodynamics (Технічна термодинаміка)	4,5	Assessment 4
MC16	Hydraulics (Гідравліка)	3,5	Assessment 4
MC17	Fundamentals of Techical Systems Design (Основи конструювання технічних систем)	5	Exam 5
MC18	Theory and Calculation of Impeller Machines (Теорія і розрахунок лопатевих машин)	7	Exam 5,6
MC19	Theory and Computation of Impeller Machines (TW) (Теорія і розрахунок лопатевих машин(КР))	2	def. Assessment 6
MC20	Structure and Strength of Aircraft (Конструкція і міцність літальних апаратів)	4	Assessment 5
MC21	Fluid and Gas Dynamics (Гідрогазодинаміка)	4,5	Exam 5
MC22	Fundamentals of Construction of Technical Systems (Term Paper) (Основи конструювання технічних систем (КП))	2	Exam 6
MC23	Theory of Air-Jet Engines (Теорія повітряно-реактивних двигунів)	4,5	Exam 6
MC24	Theory of Air-Jet Engines (TP) (Теорія повітряно-реактивних двигунів (КП))	2	def. Assessment 7
MC25	Engine Manufacturing Technology (Технологія двигунобудування)	4	Exam 6,8
MC26	Design and Dynamics of AE and PP (Конструкція і динаміка АД і ЕУ)	9,5	Assessment 7

MC27	Aircraft Maintenance (Технічна експлуатація повітряних суден)	4	Exam 7
MC28	Electrical Engineering (Електротехніка)	3	Assessment 7
MC29	Maintenance, Repair and Use of Aircraft Engines in Land Power Plants (Експлуатація, ремонт та використання авіаційних двигунів у наземних установках)	3,5	Exam 8
MC30	Design, Dynamics and Strength of AE and PP (TW) (Конструкція, динаміка та міцність АД та ЕУ (КП))	2	def. Assessment 8
MC31	Basics of Technical Diagnos (Основи технічної діагностики)	3	Exam 8
MC32	Introductory Training (Ознайомча практика)	3	Assessment 4
MC33	Industrial Training (Виробнича практика)	3	Assessment 6
MC34	Bachelor`s Thesis (Кваліфікаційна робота бакалавра)	9	defense of a bachelor's thesis
The total amount of required components		179	
Selective components (SC)			
Humanitarian unit (Soft skills)			
SC1	Language Competences (Foreign Language) (Мовні компетентності (іноземна мова))	6	Assessment 1, def. Assessment 2
SC2	Legal Competence (Правова компетентність)	3	Assessment 1
SC3	Ukrainian Studios (Українські студії)	3	Assessment 1
SC4	Humanities or Economic Elective Course (Гуманітарна або економічна дисципліна за вибором)	3	Assessment 4
SC5	Special Chapters in Mathematics (Спеціальні розділи математики)	5	Exam 4
SC6	Formation of a systemic scientific worldview (Формування системного наукового світогляду)	3	Assessment 5
SC7	Communications (Розвиток комунікацій)	3	Assessment 6
Block of disciplines of professional orientation MINOR**			
SC8	Discipline 1	5	Exam 5c.
SC9	Discipline 2	5	Exam 6c.
SC10	Discipline 3	5	Exam 7c.
SC11	Discipline 4	5	Exam 8c.
Some elective disciplines ***			
SC12	Individually selected discipline	5	Exam 7c.
SC13	Individually selected discipline	5	Exam 6c.
SC14	Individually selected discipline	5	Exam 8c.
Total amount of selective components		61	
TOTAL AMOUNT OF EDUCATIONAL PROGRAME		240	

the applicant chooses one discipline from the lists/blocks of educational components VK1-VK7, thereby ensuring mastery and deepening of general competencies and learning outcomes aimed at acquiring social skills in accordance with the requirements of the specialty standard. The lists of constituent educational components of VK1-VK7 can be increased and updated by the decision of the branch EMC.

** the applicant can choose any block of disciplines in the MINOR professional direction. Blocks of disciplines in the MINOR professional direction can be increased and updated according to the decision of the branch EMC.

*** is the university-wide block, in which subjects for selection are offered by the departments of the University or other divisions in accordance with their areas of activity or scientific directions/schools.

3.2. Structural and logical scheme of EPP

The structural and logical scheme of the educational-professional program reflects the sequence of studying its components and is given in Appendix A (scheme or table). The scheme contains mandatory components and components of the sample block. If another sample unit is selected as the applicant for higher education, the individual trajectory of study is determined and an individual plan is drawn up.

3.3 Formation of competencies (special, professional) and program learning outcomes of the compulsory component

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
1	OK1	Geometric Simulation and Graphical Information Technologies (Геометричне моделювання та графічні інформаційні технології)	<p>Purpose: mastering the basic principles of geometric modeling, methods of representing spatial forms on a plane, design standards for design documentation, mathematical and algorithmic foundations of computer graphics.</p> <p>Task: boils down to the development of spatial representation and imagination, constructive and geometric thinking, the ability to analyze and synthesize spatial forms and relationships, the study of methods of constructing various geometric spatial objects (mainly surfaces), methods of obtaining their drawings at the level of graphic models and the ability solve tasks related to spatial objects and their dependencies on these drawings.</p>	3K4	SC7	PLO3 PLO4 PLO5 PLO15
2	OK2	Introduction to the Major (Вступ до фаху)	<p>Purpose: formation of initial knowledge and ideas about the current state and prospects of aviation science, engineering and technology.</p> <p>Task: to study the main characteristics of aircraft and missile technology, the principles of operation of aircraft and missile power plants, technology for the production of aircraft and missile technology.</p>	3K7 3K8	SC1 SC2 SC4 SC6	PLO8 PLO9 PLO10 PLO12 PLO13 PLO15 PLO17 PLO19 PLO21 PLO22
3	OK3	Linear Algebra and Analytic Geometry (Лінійна алгебра та аналітична геометрія)	<p>Purpose: to acquire fundamental knowledge of higher mathematics, which allows students to solve important practical and theoretical problems in various branches of modern mathematics and related disciplines, as well as lay the foundations for fundamental mathematical training</p> <p>Task: to lay the foundations of fundamental professional training, namely: vector algebra and analytical geometry; equations of lines and surfaces of the first and second orders; matrix calculation and methods of solving systems of linear algebraic equations; limit of a numerical sequence, limit and continuity of a function, derivative, integral calculus, functions of many variables, series, elements of harmonic analysis, multiple integrals, surface and curve integrals, etc.</p>	3K4 3K8	SC2 SC4	PLO4 PLO5 PLO7

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
4	OK4	Programming and Digital Computing Methods (Методи програмування та комп'ютерні методи обчислень)	<p>Purpose: to provide the basics of programming in appropriate languages, programming methods, algorithms for creating modern software products.</p> <p>Task: to study the basic concepts and structures of programming to create software components of computer systems.</p>	3K4 3K8	SC7	PLO3
5	OK5	Mathematical Analysis (Математичний аналіз)	<p>Purpose: to acquire fundamental knowledge of higher mathematics, which allows students to solve important practical and theoretical problems in various branches of modern mathematics and related disciplines, as well as lay the foundations for fundamental mathematical training</p> <p>Task: to lay the foundations of fundamental professional training, namely: vector algebra and analytical geometry; equations of lines and surfaces of the first and second orders; matrix calculation and methods of solving systems of linear algebraic equations; limit and continuity of a function, derivative, integral calculus, functions of many variables, series, elements of harmonic analysis, multiple integrals, surface and curve integrals, etc.</p>	3K4 3K8	SC2 SC4	PLO4 PLO5 PLO7
6	OK6	Materials Science (Матеріалознавство)	<p>Purpose: to study the production and application of materials used in production, taking into account the purpose, design and manufacturing technology.</p> <p>Task: acquaintance with the main production of modern materials.</p>	3K3 3K7 3K8	SC3	PLO2 PLO4 PLO12 PLO14
7	OK7	Theoretical Mechanics and Theory of Machines and Mechanisms (Теоретична механіка та Теорія машин і механізмів)	<p>Purpose: acquisition of knowledge and skills necessary for making informed decisions in the design and calculation of machine parts and assemblies.</p> <p>Task: mastering the criteria for the performance of machine parts and assemblies, calculation methods of various parts, familiarity with modern design methods.</p>	3K7 3K8	SC3 SC6 SC7	PLO3 PLO10 PLO16 PLO19 PLO20
8	OK8	Physics (Фізика)	<p>Purpose: to form among students of higher education an idea of the modern physical picture of the world, to provide knowledge of the most important principles and laws that determine the structure and simplest forms of movement of matter, thereby preparing them for the qualitative study of general technical and special disciplines, to provide primary knowledge of experimental study of phenomena.</p>	3K3 3K7 3K8	SC2 SC4 SC5 SC6	PLO2 PLO7 PLO9 PLO10 PLO11 PLO12 PLO13

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
			Task: to provide knowledge about the modern physical picture of the world, to teach how to apply the basic laws of physics to solving practical problems that will arise when mastering special disciplines and further professional activities, to teach research activities.			PLO14 PLO18 PLO19
9	OK9	Practice (Graphical Information Technologies) Практика (графічні інформаційні технології)	Purpose: mastering the practical skills of creating textual documentation and using graphic programs when creating design documentation. Task: formation of knowledge and skills of three-dimensional design and creation of design documentation.	3K4	SC7	PLO3 PLO4 PLO5 PLO15
10	OK10	Interchangeability and Standardization (Взаємозамінність та стандартизація)	Purpose: mastering the basics of interchangeability, standardization and metrology, acquisition of skills of use and observance of requirements of standards, performance of calculations of a choice of landings of typical conjugations Task: to obtain the necessary knowledge both in the process of further study at the university and in the subsequent practical engineering activities.	GC7 GC8	SC5 SC6	PLO17 PLO20
11	OK11	Mechanics of Materials and Structures (Механіка матеріалів і конструкцій)	Purpose: to instill skills in the application of modern engineering methods of calculations of structural elements and structures for strength, rigidity and stability. Task: to learn the application of modern engineering methods for calculating the elements of structures and structures for strength, rigidity and stability.	GC7 GC8	SC3 SC4	PLO4 PLO9 PLO16
12	OK12	Technology of Structural Materials (Технології конструкційних матеріалів)	Purpose: to provide knowledge about the significance of the field of use, physico-chemical, technological features of the processes of manufacturing blanks (parts) by processing metals by different methods. Task: to teach to apply knowledge in practice in the development of modern methods of production of workpieces, parts, assemblies, units.	GC7 GC8	SC3 SC6	PLO12 PLO15 PLO21
13	OK13	Theoretical Mechanics and Theory of Machines and Mechanisms (Term Paper) (Теоретична механіка та Теорія машин і механізмів)	Purpose: to provide knowledge and skills that are required for making grounded decisions at designing of machine parts and components. Task: to learn criteria of machine parts and components operability, to know modern methods of designing.	GC7 GC8	SC3 SC6 SC7	PLO3 PLO10 PLO16 PLO19 PLO20

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
		(КП)				
14	OK14	General Arrangement of Aircraft Engines and Power Plants (Загальний устрій авіаційних двигунів та енергетичних установок)	Purpose: to provide a general knowledge on design arrangement and working process of aircraft engines. Task: to acknowledge arrangement and working processes of aircraft engines and power plants	GC4 GC8	SC2 SC3	PLO3 PLO5 PLO10 PLO11 PLO19
15	OK15	Enginering Thermodynamics (Технічна термодинаміка)	Purpose: to acquire knowledge, skills and abilities that will allow to develop simplified semantic and mathematical models of thermodynamics and heat transfer processes in aerospace objects. Task: practical realization of possibilities of thermodynamic analysis, determination of efficiency of power installations and the basic sources of losses of working capacity, calculation of a temperature condition of the simplest geometrical analogues of elements of objects of aerospace engineering.	GC7 GC8	SC2	PLO3 PLO4 PLO19
16	OK16	Hydraulics (Гідравліка)	Purpose: mastering the basic principles of hydraulics. Task: the influence of different geometric and kinematic characteristics on the hydrostatic and hydrodynamic parameters of the flow, as well as the influence of geometric parameters on the operation of pumps and units of aircraft systems.	GC7 GC8	SC2	PLO4 PLO13 PLO19
17	OK17	Fundamentals of Techical Systems Design (Основи конструювання технічних систем)	Purpose: to calculate and design parts and components of aerospace and rocket technology Task: study of bases of calculations and designing, criteria of serviceability of details and knots of cars, mastering of methods of calculation of various details, acquaintance with modern methods of designing.	GC6 GC7 GC8	SC3 SC4	PLO4 PLO8 PLO9 PLO10 PLO15 PLO17
18	OK18	Theory and Calculation of Impeller Machines (Теорія і розрахунок лопатевих машин)	Purpose: mastering the basic principles of the theory of bladed machines of gas turbine engines. Task: to study the principles of operation of blade machines of different types, basic equations and relations that reflect gas-thermodynamic processes in the flowing purities of blade machines.	GC7 GC8 GC11 GC12	SC3 SC4 SC7	PLO4 PLO5 PLO8 PLO9 PLO12 PLO15
19	OK19	Theory and Computation of Impeller Machines (TW) (Теорія і розрахунок	Purpose: application of the theory of bladed machines of gas turbine engines in the design of stages and multistage compressors and turbines and the development of control systems.	GC7 GC8	SC3 SC4 SC7	PLO4 PLO5 PLO8

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
		лопатевиx машин(КР))	Task: the ability to choose the parameters at the design stage, to perform them on the basis of calculations sketch designs of bladed machines of gas turbine engines.			PLO9 PLO12 PLO15
20	OK20	Structure and Strength of Aircraft (Конструкція і міцність літальних апаратів)	Purpose: to give students knowledge about the design of aircraft on the load of structural elements of the glider and aircraft and helicopter systems on ways to reduce the weight of the structure and ensure strength during design and operation. Task: study of the discipline: to give the necessary level of knowledge about the load of the glider structure and aircraft and helicopter systems, the operation of units under load, their design features and strength calculations in the glider structure, their design and power schemes (DPS), assumptions and design and technological implementation .	GC1 GC3 GC7 GC11 GC12	SC2 SC3 SC4 SC5 SC7 SC9 SC10	PLO1 PLO3 PLO4 PLO5 PLO7 PLO8 PLO9 PLO10 PLO13 PLO15 PLO16 PLO19
21	OK21	Fluid and Gas Dynamics (Гідрогазодинаміка)	Purpose: study - the acquisition of knowledge, skills and abilities that will develop simplified semantic and mathematical models of gas-dynamic processes in heat engines. Task: the applicant must have basic knowledge in the field of hydrodynamics and be able to use them.	GC3 GC7 GC8	SC2	PLO3 PLO4 PLO19
22	OK22	Fundamentals of Construction of Technical Systems (Term Paper) (Основи конструювання технічних систем (КП))	Purpose: to gain experience and practical skills in solving problems related to the design of parts and components of aerospace technology. Task: calculations and design of one of the components of aircraft engines, helicopters, design of drives of technological equipment.	GC6 GC7 GC8	SC3 SC4	PLO4 PLO8 PLO9 PLO10 PLO15 PLO17
23	OK23	Theory of Air-Jet Engines (Теорія повітряно-реактивних двигунів)	Purpose: knowledge of the basic provisions of the theory of bladed machines of gas turbine engines. Task: to study the principles of operation of blade machines of different types. Design and execute on the basis of calculations sketch designs of bladed machines of gas turbine engines.	GC7 GC8	SC4 SC5 SC7	PLO4 PLO5 PLO8 PLO9 PLO12 PLO15
24	OK24	Theory of Air-Jet Engines (ТР) (Теорія повітряно-реактивних двигунів (КП))	Purpose: mastering the basic provisions of the theory of air-jet engines in practice when choosing parameters. Knowledge: study of the principle of operation of air-jet engines.	GC7 GC8 GC10 GC11 GC12	SC3 SC4 SC7	PLO4 PLO5 PLO8 PLO9 PLO12 PLO15

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
25	OK25	Engine Manufacturing Technology (Технологія двигунобудування)	Purpose: technological training of specialists in the field of aircraft engine construction using computer technology. Task: to acquire knowledge about the formation of surfaces and methods of processing parts on metal-cutting machines and to obtain initial information about CNC machines.	GC 6 GC7 GC8 GC10 GC11 GC12	SC3 SC4 SC5	PLO4 PLO8 PLO10 PLO12 PLO14 PLO15 PLO17 PLO20 PLO21
26	OK26	Design and Dynamics of AE and PP (Конструкція і динаміка АД і ЕУ)	Purpose: the acquisition by applicants of knowledge on the design of aircraft engines. The problem of formation at applicants of initial representations about models of strength reliability of elements of AE on the basis of previously studied theoretical courses is solved. Task: to study a theoretical course, to perform laboratory and practical works and a course project "Compressor GTE".	GC1 GC2 GC4 GC 6 GC 7 GC 8 GC10 GC11 GC12	SC1 SC2 SC3 SC4 SC5 SC7	PLO4 PLO5 PLO7 PLO8 PLO9 PLO10 PLO14 PLO15 PLO16 PLO17 PLO19
27	OK27	Aircraft Maintenance (Технічна експлуатація повітряних суден)	Purpose: mastering the basic provisions for the organization of maintenance, maintenance and repair of JSC, maintaining a given level of reliability and flight safety. Task: mastering the scientific base in the field of organization and implementation of processes of technical operation of air transport; consolidation of previously acquired knowledge in the following disciplines: basics of aviation and astronautics; computer science and basics of programming; aerodynamics and flight dynamics; theory, design of aircraft and aircraft engines, etc., mastering the practical skills of maintenance and safe performance of standard maintenance work; intensification of education and preparation of the student for the choice of branch and specialty of practical activity in new market conditions.	GC4 GC5 GC7 GC8 GC11 GC12	SC7 SC9 SC10	PLO3 PLO7 PLO9 PLO16 PLO17 PLO23 PLO24
28	OK28	Electrical Engineering (Електротехніка)	Purpose: To teach students to use methods and models of electrical engineering in creating hardware for computer systems. Task: to study electrical and electronic tools for use in the practice of computer science.	GC7 GC8	SC4	PLO4 PLO18

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
29	OK29	Maintenance, Repair and Use of Aircraft Engines in Land Power Plants (Експлуатація, ремонт та використання авіаційних двигунів у наземних установках)	Purpose: to give knowledge in the field of working processes in elements of gas turbine engines of new knowledge on a design of elements of ground GTE. Knowledge: study of methods and approaches to the creation of highly efficient ground installations based on aircraft gas turbine engines.	GC5 GC6 GC7 GC8 GC10 GC11 GC12	SC2 SC5 SC9 SC10	PLO4 PLO5 PLO8 PLO13 PLO18 PLO19 PLO23 PLO24
30	OK30	Design, Dynamics and Strength of AE and PP (TW) (Конструкція, динаміка та міцність АД та ЕУ (КП))	Purpose: acquisition by applicants of knowledge on the design of aircraft gas turbine engines. Task: construction of various components of aircraft engines and individual parts (compressors, turbines, combustion chambers, etc.), loads of the main structural elements of the engine and methods of calculating their strength, structural materials.	GC1 GC2 GC4 GC6 GC7 GC8 GC10 GC11 GC12	SC1 SC2 SC3 SC4 SC7	PLO4 PLO5 PLO7 PLO8 PLO9 PLO10 PLO11 PLO12 PLO15 PLO16
31	OK31	Basics of Technical Diagnos (Основи технічної діагностики)	Purpose: the formation of students' competencies related to the basics of determining the technical condition of aircraft and AD in general, their elements and functional systems. Task: formation of knowledge: about the general concepts of technical diagnostics of FV and AE; methods of solving diagnostic problems; characteristics of the main elements of the diagnostic system; methods and means of diagnosing FV and AE in general, their elements and functional systems.	GC3 GC6 GC7 GC8 GC10 GC11 GC12	SC1 SC2 SC7 SC8 SC10	PLO10 PLO11 PLO13 PLO17 PLO22
32	OK32	Introductory Training (Ознайомча практика)	Purpose: testing and consolidation of acquired knowledge, skills and abilities in general engineering and professionally-oriented disciplines, providing information and production base for course projects, study and mastering disciplines. Task: to create the processing scheme and the sketch of technological operation, to edit the working drawing according to modern standards.	GC5 GC7 GC8	SC3 SC4 SC6 SC7	PLO3 PLO4 PLO12 PLO15 PLO17 PLO20 PLO21
33	OK33	Industrial Training (Виробнича практика)	Purpose: to provide an information and production base for the implementation of the bachelor's thesis project.	GC1 GC 5	SC3 SC5	PLO8 PLO10

№ за/п	EPP code	Names of the components of EPP	The purpose and objectives of the EPP component	Formation of competence.		Program learning outcomes
				General.	Special.	
			Task: to make the design and technological analysis of the set detail.	GC 6 GC 7 GC 8 GC 9	SC6 SC7	PLO12 PLO14 PLO15 PLO17 PLO20 PLO21
34	OK34	Bachelor`s Thesis (Дипломна робота (проект) бакалавра)	Purpose: to provide students with knowledge of the structure and order of graduation. Task: to study the standards, qualification requirements for bachelors and requirements for the order of registration and defense of the bachelor's thesis.	GC1 GC5 GC6 GC7 GC8 GC9	SC3 SC5 SC6 SC7	PLO4 PLO6 PLO8 PLO10 PLO12 PLO17 PLO20 PLO21

Selective components, their content, the formation of competencies (professional, special) and the definition of program learning outcomes are presented in the work programs of disciplines and syllabuses on the website <https://khai.edu.ua/> in the section "Brief description, structure and educational components of educational programs and components for bachelors".

4. HIGHER EDUCATION CERTIFICATION FORM

Attestation of graduates in the educational-professional program " Design, Operational Diagnostics, Maintenance and Repair of Aircraft Engines and Power Plants " in the specialty 134

" Aerospace Engineering " is carried out in the form of defense of bachelor's thesis and ends with the issuance of a state document on bachelor's degree qualification: Bachelor in Aerospace Engineering in Field Mechanical Engineering

Certification is carried out openly and publicly.

**5 TABLES OF COMPATIBILITY OF SOFTWARE COMPETENCES TO COMPONENTS
EDUCATIONAL PROFESSIONAL PROGRAM**

Program competencies	Components of the educational program																																				
	MC1	MC2	MC3	MC4	MC5	MC6	MC7	MC8	MC9	MC10	MC11	MC12	MC13	MC14	MC15	MC16	MC17	MC18	MC19	MC20	MC21	MC22	MC23	MC24	MC25	MC26	MC27	MC28	MC29	MC30	MC31	MC32	MC33	MC34			
GC1																					+						+				+			+			
GC2																												+					+				
GC3						+		+													+	+											+				
GC4	+		+	+	+				+					+													+	+				+					
GC5																													+		+			+	+	+	
GC6																	+						+			+	+			+	+	+	+	+	+	+	
GC7		+				+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
GC8		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
GC9																																				+	+
GC10																									+	+	+			+	+	+					
GC11																			+		+				+	+	+	+				+	+				
GC12																			+		+				+	+	+	+				+	+				
SC1		+																									+				+	+					
SC2		+	+		+									+	+	+				+	+						+			+	+	+					
SC3						+	+				+	+	+	+			+	+	+	+		+		+	+	+				+			+	+	+		
SC4		+	+		+						+						+	+	+	+		+	+	+	+	+			+			+		+			
SC5											+										+			+		+	+				+				+	+	
SC6		+					+				+		+																						+	+	+
SC7	+			+			+		+				+					+	+	+			+	+		+	+				+	+	+	+	+	+	
SC8																																		+			
SC9																					+								+		+						
SC10																					+								+		+			+			

APPENDIX A STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROFESSIONAL PROGRAM

