


MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
National Aviation University  
Faculty of Aerospace  
Aircraft Continuing Airworthiness Department

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« 13 » 09 2023

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« 17 » 09 2023



Quality Management System  
COURSE TRAINING PROGRAM

on

«Methodology of Applied Research in the Field of Aviation Transport»

Educational Professional Program: Maintenance and Repair of Aircraft and Aircraft Engines  
Educational Professional Program: Airport Technologies and Technical Equipment

Field of study: 27 Transport  
Specialty: 272 Aviation Transport

Form of training	Semester	Total (hours/ECTS credits)	Lectures	Practicals	Labs	Self-study	HW/TP	Form of semester control
Full-time	1	105/3,5	17	17	-	71	HW-1	Graded test 1s

Index: CM-1-272-1/21-2.1.1  
Index: CM-1-272-2/21-2.1.1

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Quality management system,  
course training program  
academic discipline  
«Methodology of Applied Research in the Field of  
Aviation Transport»

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Code

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The course training program of the discipline "Methodology of Applied Research in the Field of Aviation Transport" is developed on the basis of the educational professional program "Maintenance and Repair of Aircraft and Aircraft Engines", "Airport Technologies and Technical Equipment" curriculum № CM-1-272-1/21 amended, № ECM-1-272-1/22, CM-1-272-2/21 amended, № ECM-1-272-2/21 training of applicants for higher education of the educational degree "Master" in the specialty 272 "Aviation Transport" and relevant regulatory documents.

Developed by:


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The course training program was discussed and approved at a meeting of the Graduating Department of the Educational and Professional Program "Maintenance and Repair of Aircraft and Aircraft Engines", specialty 272 "Aviation Transport" - Aircraft Continuing Airworthiness Department, Minutes № 7 " 22 " 05 2022

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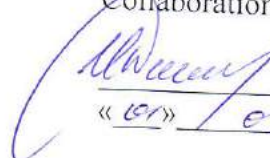
The course training program was discussed and approved at a meeting of the Graduating Department of the Educational and Professional Program "Airport Technologies and Technical Equipment", specialty 272 "Aviation Transport" - Department of Airport Technologies, Minutes № 1 " 23 " 2022

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« 07 » / 05 2022

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## INTRODUCTION

The Course Training Program of the discipline " Methodology of applied research in the field of aviation transport " was developed on the basis of "Methodical recommendations for the development and design of a working program of the discipline of full-time and part-time forms of education", approved by the rector's order of 29.04.2021 No 249 / unit, and relevant regulatory documents.

### 1. EXPLANATORY NOTE

#### 1.1. Place, purpose, objectives of the discipline.

Location: this discipline is the theoretical and practical basis of knowledge and skills that form the profile of a specialist researcher in the field of air transport.

The purpose of teaching the discipline is:

- formation of students' fundamentals of the methodology of scientific research, disclosure of modern scientific concepts, concepts, methods of conducting theoretical and experimental research;
- providing the basics of scientific research used in the field of production, operation, maintenance and repair of air transport facilities.

The objectives of the discipline are:


- acquaintance with the goals and objectives of science as a type of creative human activity, features of the scientific method, principles of choosing a research topic and justification of its relevance;
- study of methods for conducting information search and analysis of the state of the investigated problem, the main stages of choosing a research topic, methods of analysis and design of scientific research results, requirements of standards for the preparation of a report on research work, principles of preparation and implementation of completed research works in production and evaluation of their effectiveness, preparation of scientific materials for publication;
- mastering the basics of system analysis, principles and methods of organizing and conducting theoretical and experimental research, the main stages and principles of building models of research objects, the principles of metrological support of research, methods of processing research results and assessing errors, methods for assessing the adequacy of the results (models), the basic concepts of experiment planning;
- mastering the goals and objectives of typical research in the field of production, operation, maintenance and repair of aviation equipment, methods for determining their relevance, scientific and practical significance,
- principles of using computer technologies for conducting and processing research results;
- intensification of training and orientation of students to independent activities in research and development in the field of production, operation, maintenance and repair of aviation equipment.

#### 1.2. Result training, which makes it possible to achieve academic discipline:

**For the Educational Professional Program: «Aircraft Maintenance and Repair of Aircraft and Aircraft engines»:**

- specialized conceptual knowledge, which includes modern scientific achievements in the field of air transport and is the basis for original thinking and conducting research. Apply modern methods of scientific research, organization and planning of experiments, digital technologies, methods of data analysis to solve complex problems of air transport. (PLO 01);
- solve complex problems of creation, operation, maintenance, repair and disposal of aviation transport facilities, including at the border with related fields, engineering sciences, physics, ecology and economy (PLO 02);
- freely present and discuss the results of research and innovation, other issues of professional activity in the state language and in English or one of the languages of the countries of the European Union in oral and written forms (PLO 03);
- apply universal and specialized life cycle management, automated design, manufacturing and engineering research systems in professional activities (PLO 05);
- organize and manage the work of the primary production, design or research unit in the field of aviation transport, evaluate the efficiency and effectiveness of the staff and unit (PLO 07);
- develop and analyze physical, mathematical and computer models related to the creation, operation, maintenance and repair of aviation transport facilities (PLO 08);



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- perform technical and economic calculations, comparison and justification of projects for production, repair, renovation, operation, maintenance of aviation transport facilities in accordance with specialization (PLO 11);

- make effective decisions on air transport issues, including in difficult and unpredictable conditions; predict its development; determine the factors affecting the achievement of the set goals; analyze and compare alternatives; assess risks and likely consequences of decisions (PLO 12);

- search for necessary data in scientific literature, databases and other sources, analyze, evaluate and use these data (PLO 14);

- develop and optimize the parameters of air transport objects and systems and technological processes, including using automated computer design for the production of nodes, aggregates and systems of air transport objects (PLO 16);

- to develop models that allow forecasting the change in the technical condition of aircraft and their components, to monitor the parameters of the efficiency of its technical operation based on modern analytical methods and complex models (PLO 19).

**For the Educational Professional Program: «Airport Technologies and Technical Equipment»:**

- to apply modern methods of scientific research, organization and planning of the experiments, digital technologies, methods of data analysis to solve complex problems in the field of air transport, in particular of airport operation and operation of aviation ground equipment and airport equipment (PLO 02);

- to develop and to analyses physical, mathematical and computer models related to the creation, operation, maintenance and repair of air transport, in particular of aviation ground handling facilities and airport equipment (PLO 09);

- to search necessary data in scientific literature, databases and other sources, to analyze, to evaluate and to use these data (PLO 15).

**1.3. To the identity that gives the opportunity to obtain an academic discipline:**

**for the Educational Professional Program: «Aircraft Maintenance and Repair of Aircraft and Aircraft engines»:**

- the ability to solve complex tasks of a research and/or innovative nature in the field of air transport or in the process of further education using the provisions, theories and methods of natural, technical, informational and socio-economic sciences, which is characterized by the complexity and uncertainty of conditions (IC);

- knowledge and understanding of the subject area and understanding of professional activity (GC 01);

- the ability to conduct research at the appropriate level (GC 04);

- ability to search, process and analyze information from various sources (GC 05);

- the ability to identify, pose and solve problems (GC 06);

- the ability to make informed decisions (GC 07);

- the ability to develop and implement scientific and applied projects in the field of aviation transport (PC 01);

- the ability to apply a systematic approach to solving engineering interdisciplinary problems in aviation transport (PC 02);

- the ability to integrate knowledge and solve complex scientific and industrial problems in the field of aviation transport, taking into account the wider interdisciplinary engineering context (PC 04);

- ability to implement modern technologies, research, analyze and improve technological processes of air transport (PC 06);

- the ability to choose optimal materials, equipment and measures for the implementation of the latest technologies in air transport (PC 07);

- skills in maintenance and repair of aircraft and their components (PC 08);


- the ability to develop models that allow predicting changes in the technical condition of aircraft and their components, monitoring the parameters of the efficiency of their operation on the basis of modern analytical methods and complex models (PC 10);

- the ability to develop organizational and technical, regulatory and technical documentation for maintenance and repair of aircraft and aircraft engines (PC 11).

**For the Educational Professional Program: «Airport Technologies and Technical Equipment»:**

Ability to solve complex research and/or innovation problems in the field of airport functioning, operation of aviation ground equipment and airport equipment or in the process of further training using



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the provisions, theories and methods of natural, technical, information and socio-economic sciences, characterised by complexity and uncertainty of conditions (IC).

- knowledge and understanding of the subject area and understanding of professional activities (GC 01);
- skills of using of information and communication technologies (GC 03);
- ability to conduct research at the appropriate level (GC 04);
- ability to search, to process and to analyze information of various sources (GC 05);
- ability to identify, to set and to solve problems (GC 06);
- ability to make informed decisions (GC 07);
- ability to evaluate and to ensure the quality of the performed works (GC 09);
- ability to develop and to implement scientific and applied projects in the field of air transport, in particular of airport operation and operation of aviation equipment and airport equipment (PC 01);
- ability to apply a systematic approach to solving engineering interdisciplinary problems in the field of air transport, in particular of airport operation and operation of aviation ground equipment and airport equipment (PC 02);
- ability to integrate knowledge and to solve complex scientific and industrial problems in the field of air transport, in particular of airport operation and operation of aviation ground equipment and airport equipment, taking into account the wider interdisciplinary engineering context (PC 04);
- ability to implement modern technologies, to re-search, to analyze and to improve technological processes in the field of air transport, in particular of airport operation and operation of aviation ground equipment and airport equipment (PC 06);

#### 1.4. Interdisciplinary connections.

This discipline is based on the knowledge obtained during preparation for the Bachelor's degree and is the basis for studying further disciplines, namely:

**for the Educational Professional Program: «Aircraft Maintenance and Repair of Aircraft and Aircraft engines»:**

“Business Foreign Language”, “Mathematical Methods for Modeling Systems and Processes”, “Statistical Estimation and Problem Solving”, “Diagnostics and Control Systems of Aircraft Technical Condition”, “Course work on the discipline Diagnostics and Control Systems of Aircraft Technical Condition”, “Informational Technologies for Providing Maintenance Processes for Aviation Equipment”, “Maintaining Airworthiness of Aircraft (ICAO Doc. 9760)”, “Course project on the discipline Maintaining Airworthiness of Aircraft (ICAO Doc. 9760)”, “Research Activity in the Field of Maintenance and Repair of Aircraft and Aircraft Engines”, “Pre-diploma practice”, passing the certification exam and the implementation of qualification work.

**for the Educational Professional Program: «Airport Technologies and Technical Equipment»:**

“Business Foreign Language”, “Informational Technologies for Providing Maintenance Processes for Aviation Equipment”, “Mathematical Modelling of Airport Technological Processes”, “Operation of Aviation Ground Equipment and Airport Equipment”, “Research Activity in the Field of Maintenance and Repair of Aircraft and Aircraft Engines”, “Pre-diploma practice”, passing the certification exam and the implementation of qualification work.

## 2. THE PROGRAM OF THE DISCIPLINE

### 2.1. Contents of the discipline

The educational material of the discipline is structured according to the modular principle and consists of one training module, namely: **Modul No 1 "Methodology of applied research in the field of air transport"**, which is a logically complete, relatively independent, integral part of the discipline, the assimilation of which involves a modular control points and analysis of the results of its implementation.

### 2.2. Modular structuring and integrated requirements for each module

**Modul № 1 "Methodology of applied research in the field of air transport"**

**Integrated requirements of module № 1:**

As a result of mastering the educational material of module No 1 "Methodology of applied research in the field of air transport", the student must:

**Know:**

- the place of science in the system of knowledge;





- on the basic concepts of the method and methodology of scientific research;
- on the basic stages, the content of the goal, and the objectives of scientific research;
- the use of system analysis in scientific research;
- enterprises and methods of organizing and conducting theoretical and experimental research, building models of research objects;
- typical directions and methods of experimental research in the field of production, operation, maintenance and repair of aircraft facilities;
- principles of mathematical planning of the experiment, methodology and processing of research results and metrological support of experimental research.

**Be able to:**

- it is necessary to search, process and analyze scientific and technical information from various sources.
- independently identify, set and solve scientific and technical problems in the field of air transport, develop appropriate programs and research methods;
- to apply modern methods of modeling and system analysis in scientific research;
- to carry out experimental research of objects and technological processes of air transport;
- develop practical recommendations using research results.

**Topic 1. Entry. Science and research. Fundamentals of scientific research methodology.**

The place of science in the system of knowledge. Scientific research, its essence and features, goals and objectives of scientific research. The concept of the method and methodology of research. The main stages of scientific research

**Topic 2. Methods and principles of theoretical scientific research. Modeling in scientific research.**

Methods of theoretical research. Methods of physical and mathematical modeling in scientific research.

**Topic 3. System analysis in scientific research.**

The concept of system analysis. Structure and characteristics of technical systems. Classification of systems. The practice of applying system analysis in scientific research.

**Topic 4. Methods and principles of experimental research.**

Initial data for experimental research. Methodology of the experiment. The role, place and directions of experimental research and testing in ensuring the reliability and maintenance of airworthiness of aviation equipment.

**Topic 5. Methods of experimental research to determine the mechanical characteristics of materials and structural elements of aircraft.**

The main mechanical characteristics of materials. Tensile testing. Test for striking strength. Fatigue test. Test for heat resistance and creep. Full-scale resource tests of aviation equipment.

**Topic 6. Methods of experimental research with the definition of tribotechnical characteristics of materials.**

General information for friction and wear in machines. Tribomechanical characteristics of materials. Experimental methods for determining tribotechnical characteristics. Methods of tribotechnical tests.

**Topic 7. Special methods of experimental research. Methodology for research on malfunctions and failures of aircraft facilities.**

Metallographic and special laboratory research methods. General provisions and procedure for conducting research to establish the causes of occurrence and malfunction of aviation equipment.

**Topic 8. Mathematical planning of the experiment and metrological support of experimental research.**

Basic concepts about experiment planning. Plans for a complete factorial experiment. Plan a fractional factor experiment. Construction and statistical analysis of mathematical models. Basic concepts of measuring physical quantities. Classification of measuring instruments. Measurement errors. Metrological characteristics of measuring instruments.





### 2.3. Training schedule of the subject

№ cf.	Topic name (thematic section)	Volume of training sessions (hours)			
		Full-time education			
		All	Lecture	Practics	Self- study
1	2	3	4	5	6
1.1	Entry. Science and research. Fundamentals of research methodology	1 semester			
		7	2	2	3
1.2	Methods and principles of theoretical scientific research. Modeling in scientific research	9	2	2	5
1.3	System analysis in scientific research	13	2	2	9
1.4	Methods and principles of experimental research	9	2	2	5
1.5	Methods of experimental research to determine the mechanical characteristics of materials and structural elements of aircraft.	13	2	2	9
1.6	Methods of experimental research with the determination of tribotechnical characteristics of materials	13	2	2	9
1.7	Special methods of experimental research. Methodology for research on malfunctions and failures of aircraft facilities	9	2	2	5
1.8	Mathematical planning of the experiment and metrological support of experimental research	10	2	3	5
1.9	Homework	8	-	-	8
1.10	Modular control work №1	5	1	-	4
<b>Total by module № 1</b>		<b>105</b>	<b>17</b>	<b>17</b>	<b>71</b>
<b>Total by academic discipline</b>		<b>105</b>	<b>17</b>	<b>17</b>	<b>71</b>

### 2.4. Homework

Homework in the disciplines is carried out in order to consolidate and deepen the theoretical knowledge and skills acquired by the student in the process of mastering the educational material of the discipline.

The task of the is to search for information on the selected research topic (systematization of literary sources on the research topic for the period 3... 5 years) and development and justification of the previous model of the object in the direction of research.


Implementation, registration and protection of the is carried out by the student individually in accordance with the guidelines. The time required to complete the is up to 8 hours of independent work.

### 2.5. Tasks for home work.

The test work on the discipline is carried out in the first semester, in accordance with the methodological recommendations approved in accordance with the established procedure, in order to consolidate and deepen the theoretical and practical knowledge and skills acquired in the process of mastering the educational material of the discipline in the field of air transport, and is one of the final in the formation of the profile of a specialist in the maintenance and repair of aircraft and aircraft engines.

The specific purpose of the test is to consolidate the theoretical knowledge of students in the discipline "Methodology of applied research in the field of air transport" and their acquisition of practical skills and abilities regarding the main technological processes used in the processing and manufacture of parts in the production and repair of aircraft and aircraft engines.



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Execution, design and protection of the test work is carried out by the student individually in accordance with the guidelines. To perform the control (home) work is provided 8 hours of independent work.

### 2.6. List of questions to prepare for the differential test.

The list of questions and the content of tasks for the preparation of the differential test are developed by the leading teacher of the department in accordance with the work program, approved at a meeting of the department and communicated to students.

## 3. EDUCATIONAL AND METHODOLOGICAL MATERIALS ON THE DISCIPLINE

### 3.1. Teaching methods

In the process of teaching the material of the discipline in the process of conducting lectures, practical and other types of training sessions, passive verbal methods (explanations, lectures) are used using a classroom board and video materials, active practical methods (exercises) and control methods.

When presenting the material at the lectures, multimedia equipment can be used, when considering and conducting laboratory classes, computer equipment can be used to use search and analytical work and carry out calculations and laboratory equipment. Lectures and laboratory classes can be conducted in distance learning mode.

### 3.2. Recommended Reading

#### Basic literature

3.2.1. Chumak V.L., Ivanov S.V., Maksymyuk M.R. Fundamentals of scientific research: textbook – K.: NAU-printing, 2019. – 304 p.

3.2.2. Pylypchuk M.I., Kirik M.D., Grigoriev A.S. and others. Mathematical planning of a multivariate experiment: Textbook. posib. – L.: UkrDLTU, 2004.– 54 p.

3.2.3. Biley P.V., Dovga N.D., Khanyk Y.M. and others. Methodology of scientific research of technological processesin: Textbook. posib. – L.: Panorama, 2013. – 182 p.

3.2.4. Dushinsky V.V. Fundamentals of scientific research. Theory and practice with software: Textbook. Posib. – K.: KPI, 1998. – 408 p.

#### Supporting literature

3.2.5. Звіти у сфері науки і техніки. Структура та правила оформлювання: ДСТУ 3008:2015. – На зміну ДСТУ 3008-95; [Чинний з 2017–07–01]. – К.: ДП «УкрНДНЦ» 2016. – 26 с.

3.2.7. Підручник дослідника. О.М. Васильковський, С.М. Лещенко, К.В. Васильковська, Д.І. Петренко / Навчальний посібник для студентів агротехнічних спеціальностей. – Кіровоград: 2016. – 204 с.



3.2.8. Основи методології та організації наукових досліджень: Навч. посіб. для студентів, курсантів, аспірантів і ад'юнтів / за ред. А. Є. Конверського. – К.: Центр учбової літератури, 2010. – 352 с.

### 3.3. Information resources on the Internet

3.3.1. <http://utg.ua>

3.3.2. <http://jrn1.nau.edu.ua/index.php/visnik>



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#### 4. RATING SYSTEM FOR ASSESSING THE KNOWLEDGE AND SKILLS ACQUIRED BY THE STUDENT

4.1 Evaluation of certain types of educational work performed by the student is carried out in points in accordance with table. 4.1.

Table 4.1

Type of educational work	Mach number of points
	Full-time education
<b>1 semester</b>	
<b>Module № 1 "Methodology of applied research in the field of air transport"</b>	
Performing tasks for knowledge of theoretical material	12 (total)
Implementation and protection of practical work	48 (total)
Doing and protecting homework	15
Performing and protecting control (home) work	-
<i>For admission to the modular test № 1, the student must score at least</i>	45
Implementation of the modular test work № 1	25
Final semester test work	-
<b>Total by module № 1</b>	<b>100</b>
<b>Total by discipline</b>	<b>100</b>

*The credit rating is* determined (in points and on a national scale) based on the results of all types of educational work during the semester.

4.2. Completed types of educational work are credited to the student if he received a positive rating for them (Appendix 3).

4.3. The sum of the rating marks received by the student for certain types of educational work performed is the current modular rating assessment, which is recorded in the modular control information.

4.4 In the case of **differentiated credit**, the final semester rating grade is transferred to the score on the national scale and the ECTS scale.

4.5. The final semester rating grade in points, according to the national scale and the ECTS scale, is recorded in the student's test and examination sheet, for example, as follows: **92/Vidm./A, 87/Dobre/B, 79/Dobre/C, 68/Zadov./D, 65/Zadov./E, etc.**

4. 6. The final rating grade in the discipline is equal to the final semester rating assessment. The specified final rating assessment in the discipline is recorded in the Diploma Supplement.





(Ф 03.02 – 01)

### АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки
	<i>УСД СД</i>		<i>Мисюк І.М.</i>	<i>[Signature]</i>	

(Ф 03.02 – 02)

### АРКУШ ОЗНАЙОМЛЕННЯ З ДОКУМЕНТОМ

№ пор.	Прізвище ім'я по-батькові	Підпис ознайомленої особи	Дата ознайомлення	Примітки

(Ф 03.02 – 04)

### АРКУШ РЕЄСТРАЦІЇ РЕВІЗІЇ

№ пор.	Прізвище ім'я по-батькові	Дата ревізії	Підпис	Висновок щодо адекватності

(Ф 03.02 – 03)

### АРКУШ ОБЛІКУ ЗМІН

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла зміну	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульованого			

(Ф 03.02 – 32)

### УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				