

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
NATIONAL AVIATION UNIVERSITY  
Aerospace Faculty  
Aircraft Continuing Airworthiness Department

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Quality Management System

**Certification exam program**  
for applicants  
of a **Master's** degree

Field of Study: 27 "Transport"

Specialty: 272 "Air transport"

Educational Professional Program: **"Maintenance and Repair of Aircraft and Aircraft Engines"**

QMS NAU CEP 07.06 – 03–2023

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	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b> Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	Code of document	QMS NAU CEP 07.06 – 03–2023
		page 2 of 19	

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	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 3 of 19	

### Content

	page
1. Explanatory note .....	4
2. A list of program questions from the disciplines that are submitted to the certification exam .....	7
3. List of references .....	13
4. A rating system for evaluating the results of exam tasks .....	14
5. The list of reference sources of information that the applicant is allowed to use during the certification exam .....	16
6. Issuance of the Examination ticket .....	17
7. Completion of the exam answer sheet .....	18
8. Forms of documents .....	19

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 4 of 19	

## 1. EXPLANATORY NOTE

Certification exam program (CEP) was developed in accordance with the educational and professional program "Maintenance and repair of aircraft and aircraft engines" and curriculum No. HM-1-272-1/21 with changes.

The main goal of the certification exam is to establish the compliance of the learning outcomes of applicants for higher education with the requirements of the educational and professional program "Maintenance and repair of aircraft and aircraft engines".

After completing the educational and professional program, the recipient of the master's degree is able to demonstrate the following program learning outcomes (PLO):

Specialized conceptual knowledge that 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 objects, 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 English or one of the languages of the European Union countries in oral and written forms (PLO 03).

Develop and implement new technical solutions and apply new technologies (PLO 04).

Apply universal and specialized life cycle management (PLM), automated design (CAD), manufacturing (CAM) and engineering research (CAE) systems in professional activities (PLO 05).

Develop and implement energy-saving technologies of air transport (PLO 06).

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).

Convey your knowledge, conclusions, decisions and the grounds for their adoption to specialists and non-specialists, including students, in a clear and unambiguous form (PLO 09).

Develop technical regulations, take part in their development and organize technological processes in the field of aviation transport, ensure production safety (PLO 10).

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).

To ensure the quality of production and operation in the field of aviation transport (PLO 13).

Search for necessary data in scientific literature, databases and other sources, analyze, evaluate and use these data (PLO 14).

Determine the properties and characteristics, calculate the parameters of aviation transport objects (PLO 15).

Develop and optimize the parameters of objects and systems of air transport and technological processes, including with the use of automated computer design for the production of nodes, aggregates and systems of objects of air transport (PLO 16).

Provide maintenance and repair of aircraft and their components (PLO 17).

Develop organizational and technical, regulatory and technical documentation for maintenance and repair of aircraft and aircraft engines (PLO 18).

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 5 of 19	

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

Certification exam (CE) in the specialty is conducted by the examination commission (EC) after the applicants have completed the theoretical course of study and practical training before the beginning of the qualification work.

The examination commission is created by the order of the rector of the university, the project of which is submitted by the educational department on the proposal of the dean of the aerospace faculty, formed on the basis of the proposals of the graduation department of maintaining the airworthiness of aircraft separately for students of higher education in full-time and correspondence forms of education no later than a month before the start of their work and function within the period specified in the order.

The composition of the EC for the attestation of higher education applicants in the form of an attestation exam includes: the chairman, two members of the commission, one of whom is the deputy chairman, secretary.

A person who does not work at the university (including part-time), from among scientific and scientific-pedagogical employees of higher education institutions and leading specialists of enterprises, organizations and institutions according to the profile of the relevant specialty, is approved as the head of the EC.

The head of the graduation department or another member of the commission is approved as the deputy chairman of the EC.

As a rule, an employee of the graduation department or another member of the commission is appointed as the secretary of the EC.

Members of the EC can be leading specialists of enterprises, organizations and institutions by specialty profile, the head of the graduation department, professors. Associate professors of graduation and related departments of the university.

A group consultation must be scheduled one to three days before the CE deadline to give applicants the opportunity to get answers to specific questions or explanations and clarifications of individual questions based on the educational material presented for the exam, as well as to clarify the AI conduct procedure, peculiarities of its organization, etc. The exam should start, as a rule, from the beginning of the working day at the university.

Applicants of higher education who have successfully completed in full the curriculum of theoretical and practical training of a master's degree specialist developed by the university, in accordance with the requirements of higher education standards, are admitted to CE.

In the premises where AI is planned, individual workplaces are organized for applicants, conditions are created to provide them with reference literature, computer equipment, necessary materials, devices, etc.

The dean of the faculty submits the following documents to the EC no later than one day before the beginning of the attestation of applicants for higher education:

- extract from the order of the rector of the university regarding the personal composition of the EC and the term of its work;
- order of the dean of the faculty with a list of higher education applicants who are admitted to attestation;
- individual study plans of students completely filled out and certified by the dean of the faculty;
- memo to the head of the EC;
- certification exam program;
- package of examination tickets;
- a list of reference literature, devices, computer programs, etc., which are allowed to be used by students of higher education during CE.

The CE ticket consists of theoretical and practical parts and includes 6 tasks: 4 tasks in the theoretical part and 2 tasks in the practical part.

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 6 of 19	

The theoretical part is a series of questions to test the knowledge of applicants, covering the content of the main profiling disciplines:

- International and State Regulation of Airworthiness of Aircraft;
- Mathematical Methods of Modeling Systems and Processes;
- Maintaining the Airworthiness of Aircraft (ICAO Doc. 9760);
- Diagnostics and Control Systems of Aircraft Technical Condition

The practical part is a series of tasks to test the knowledge of applicants covering the content of the disciplines:

- Maintaining the Airworthiness of Aircraft (ICAO Doc. 9760);
- Methodology of Applied Research in the Field of Aviation Transport.

Before the start of CE, a member of the EC distributes control tasks and blank sheets of paper, which have passed the registration and have the appropriate stamp, to the test takers, gives an explanation about the registration of the results of the tasks, answers questions. Moreover, the teacher is allowed to give explanations and answer questions only regarding the wording of questions, conditions of tasks and design of results.

The number of the version of the control task is fixed by the members of the commission in the minutes of the commission meeting and must be affixed by the applicant on each sheet of paper for completing the task.

After completing the organizational work related to AI, the teacher of the department, if he is not a member of the committee, leaves the audience. In the future, only members of the commission may be in the auditorium during the exam.

During the performance of control tasks, applicants are allowed to use only those types of reference literature, equipment, devices, computer programs, etc., which are specified in the package of examination tickets. Applicants who violate this condition may have their final grade reduced to unsatisfactory by the commission's decision.

At the end of the control time for the tasks of the examination tickets, the members of the commission collect the examination tickets and sheets filled with answers from the applicants, check the presence of the number of the assignment option on all sheets and its correspondence with the number recorded in the minutes of the EC meeting.

Verification of completed tasks is carried out by members of the commission or, on their behalf, by teachers of the graduation department in the presence of commission members. The rating is issued in accordance with the existing provision on the rating system. Each checked work must have a brief comment on the assessment made by the person who checked it.

The evaluation of the subject-practical and symbolic-practical skills of the applicants when completing the second part of the examination ticket is carried out by a commission consisting of at least two members of the commission and one teacher of the graduation department. In the process of answering the tasks of the examination ticket or after its completion (for possible clarification of individual positions), the members of the commission may ask the applicant additional questions.

For the first and second (theoretical and practical) parts of the ET, applicants of higher education are given one final rating on a 100-point scale, with the subsequent transfer of the rating to the national scale ("Excellent", "Good", "Satisfactory", "Unsatisfactory") and the scale ECTS.

The decision of the EC regarding the final evaluation of the acquired knowledge, abilities, skills, and other competences of higher education students, as well as regarding the awarding of appropriate qualifications and the issuance of diplomas (diplomas with honors) is taken at a closed meeting of the EC with open voting by a simple majority of its members. Who participated in the meeting, with the mandatory presence of the chairman.

In case of an equal number of votes, the chairman's vote is decisive.

Retaking the certification exam or re-defending with the aim of increasing the grade (including a positive one on the national scale) is not allowed.

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 7 of 19	

The decision of the EC is final and is not subject to review.

The CE results are announced to the candidates by the head of the commission on the day of the exam, after its completion and preparation of protocols.

The minutes of the meeting of the EC with the marks placed in them are signed by the chairman and members of the commission, and one copy of the minutes is submitted to the dean's office of the faculty, the second to the graduate department, and the third to the educational department.

## 2. LIST OF PROGRAM QUESTIONS FROM THE DISCIPLINES WHICH ARE TAKEN ON THE CERTIFICATE EXAM

Questions of the theoretical part.

### 2.1. International and State Regulation of Airworthiness of Aircraft

1. Name the three main objectives of the document Part - 21.
2. Describe the main stages of aircraft type certification.
3. Describe the components of the certification basis for aircraft type certification.
4. Give a brief description of the certification of the operator and indicate its main stages.
5. Describe the interaction of the operator of the aircraft (Part-M) and the organization of maintenance (Part-145).
6. Give a brief description of the document Part-M.
7. Give a brief description of the document Part - 145.
8. Describe the procedure for certification of maintenance personnel (Part - 66).
9. Functions and powers of the national CAA in the approval of the organization-developer and the organization-manufacturer of the aircraft.
10. Functions and powers of the national CAA in conducting the approval procedures of the organizations Part-145 and Part-M.
11. Describe the life cycle of the aircraft with the indication of current EASA documents at separate stages (Part-21, Part-M, Part-145, Part-66, Part-147).
12. Give a brief description of the stages of certification tests in the certification of aircraft type (ground and flight tests).
13. Describe the maintenance certification procedure. What document certifies its completeness and timeliness.
14. Provide a list of documents that must be on board the aircraft when performing international flights in accordance with the Chicago Convention (1944).
15. The main stages of obtaining a certificate of aircraft continuing airworthiness. Functions and powers of the CAA.
16. Describe the procedure of aircraft state registration. Functions and powers of the operator and CAA.
17. Explain the division of responsibilities for the continuing airworthiness of an aircraft under its international lease (Article 83bis of the Convention).
18. Describe the concept of "Continuing Airworthiness Directive".
19. Give a brief description of the concepts: "State of Development", "State of Manufacturer", "State of the Operator", "State of Registry", "State of Aviation Event".
20. Describe the main functions of the CAA divisions that are involved in the regulation of airworthiness (continuing airworthiness division and airworthiness inspection division).
21. What are the main functions of the CAA of the ICAO member country in relation of airworthiness?
22. Describe the features of information exchange between the operator, CAA and organizations-manufacturers of aircraft and its components.
23. Name the main stages of maintenance organizations approval (Order of ДАСУ №286 from 06.03.2019...).
24. Name the main stages of approval of organizations-developers and organizations-manufacturers of

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 8 of 19	

aircraft and its components (Part-21).

25. Give a brief description of the document MOE (Maintenance Organization Exposition - Guide to the organization of aircraft maintenance).
26. Give a brief description of the document CAMO (Continuing Airworthiness Management Organization) of the operator.
27. Describe the main stages of aircraft operator certification.
28. Describe the main categories of maintenance personnel according to Part-66. Indicate which category of personnel has the right to approve the Certificate of Release to Service (CRS) after maintenance.
29. Describe the procedures for threat identification and risk assessment during aircraft maintenance. Give two examples.
30. Give a brief description of ICAO Doc. 9760 "Airworthiness Manual".

## 2.2. Mathematical Methods for Modeling Systems and Processes

1. What is a mathematical model?
2. What is the general problem of mathematical programming?
3. On what grounds are the tasks of operations research classified?
4. What are the main types of linear programming problems?
5. How is non-linear programming subdivided?
6. Differences in writing linear programming problems in general, standard and canonical forms.
7. Ways of transition from the general form of the problem of linear programming to the standard one.
8. Conditions for graphical solution of linear programming problems.
9. Algorithm for solving linear programming problems by a graphical method.
10. What are the main steps in solving a linear programming problem?
11. What is the difference between the transport problem and the general problem of linear programming?
12. Under what conditions is a transport task called closed, under what conditions is it open?
13. How can an open transport problem be reduced to a closed one?
14. Optimality condition for solving the transport problem.
15. Name the stages of solving the transport problem by the method of potentials.
16. What are the features of solving transport problems with bandwidth constraints.
17. What problems of linear programming are problems of distributive type?
18. Methods for solving integer programming problems. What are the main steps of their algorithms?
19. What optimization problem is related to convex programming problems?
20. What approaches do you know to solving multicriteria problems?
21. The concept of Pareto optimality.
22. What are the characteristic features of dynamic programming problems?
23. Essence of problems of stochastic programming.
24. What tasks are related to the production supply model?
25. What processes are called Markov?
26. Which flow of events is called simpler?
27. On what grounds are queuing systems classified?
28. What are the main properties of the queuing system?
29. What are the simple models of the queuing system?
30. What is a network planning model?

## 2.3. Maintaining Airworthiness of Aircraft (ICAO Doc. 9760)

1. Disclose the causes of airframe corrosion and damage caused by it. List the most likely places of damage by corrosion of the internal and external surfaces of the aircraft.
2. What are the signs of loosening of rivets and ways to eliminate the loosening?
3. What are the typical maintenance tasks of glazing and the precautions to be taken when performing these tasks?

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 9 of 19	

4. Give a description of typical damages and malfunctions of airframe contact parts. Name the typical maintenance tasks for airframe joint parts.
5. Name the reasons and possible locations of cabin tightness loss. What methods are used to check the cabin for pressurisation?
6. What is the purpose and structure of the life support system?
7. Describe a typical graph of the change in pressure with height in the pressurized cabin of a passenger aircraft.
8. The essence of the operation of the temperature and pressure regulation systems in the cabin. How does the functional check of the temperature and pressure regulation systems take place?
9. List the main elements of mechanical flight controls. What are the maintenance tasks of mechanical elements of the flight control system?
10. List the main elements of flexible flight control system. Describe the main tasks during maintenance of flexible flight control system.
11. What are the reasons for the weakening of the cable tension and its consequences? What is the procedure for checking cable tension?
12. What are the main tasks during maintenance of wheels tyres?
13. Describe the purpose and design features of shock absorbers. Specify the main malfunctions of shock absorbers.
14. What are the main works performed during maintenance of shock absorbers? What is the procedure for checking the amount of fluid in the shock absorber and refilling it?
15. Describe the operating conditions and design features of the landing gear wheel braking devices. Name the main permissible and unacceptable malfunctions of disc type brakes.
16. What is the essence of the "shimmy" phenomenon and what are the constructive measures to prevent this phenomenon? Name the reasons that cause the phenomenon of "shimmy" in operation mode.
17. Describe the factors that affect the technical condition and performance of the hydraulic system.
18. Describe the fluids used in the hydraulic system. Name the types of fluids pollution and their filtering and cleaning methods.
19. List the methods of checking the internal leakage of the hydraulic system and its units.
20. What are the features of the schemes and the principle of operation of hydraulic system with pumps of constant and variable performance and with pumping stations? Describe the features of these schemes.
21. Name the methods of control, means of control and diagnostics of the flow part of the gas turbine engine and typical malfunctions, their causes and consequences.
22. List the typical failures and malfunctions of the oil and fuel systems, as well as the causes, consequences, and signs of these failures and malfunctions. Name the main works during the maintenance of the oil and the fuel system.
23. Describe the methods of refueling Fuel System. What is the procedure for refueling the aircraft?
24. Give a general description of the process of starting an aircraft engine. Describe the characteristic stages of the starting and give their characteristics.
25. Consider typical malfunctions during start-up of the gas turbine engine.
26. Describe the start of a piston engine. What is hydraulic shock when starting a piston engine?
27. What is the purpose of warming up aircraft engines before starting? Name the warm-up modes of a turbofan engine and the features of the warm-up modes of a gas turbine engine and a piston engine.
28. What are the features of the design and flight operation of helicopters?
29. Forced vibrations of a helicopter from exciting forces. What is the phenomenon of ground resonance of a helicopter?
30. What are the peculiarities of the operational conditions of the helicopter supporting system and its maintenance? Name the main work during the maintenance of the blades of the carrier and steering rotors of the helicopter.

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 10 of 19	

#### **2.4. Diagnostics and Control Systems of Aircraft Technical Condition**

1. Name the main objectives of technical diagnostics of aircraft.
2. List the main parameters that are registered by on-board means of monitoring the operation of aircraft systems in flight.
3. Explain the main tasks of diagnosing products, components and equipment of aircraft.
4. Explain the basic methods of diagnosing aircraft.
5. Give the classification of methods for diagnosing aircraft.
6. Explain the concept of "functional diagnostics".
7. Indicate the distinctive features of functional diagnostics.
8. Explain the basic methods of collecting information for functional diagnostics.
9. Explain the essence of operational processing of initial information.
10. Explain the essence of complete processing of initial information.
11. Name the diagnostic parameters of the structural units of the flowing part of the turbojet engine.
12. List the main diagnostic parameters of the gas turbine engine.
13. Specify the diagnostic parameters of vibration diagnostics.
14. List the external factors that affect the workflow of the gas turbine engine.
15. List the internal factors that affect the workflow of the gas turbine engine.
16. Explain the essence of ultrasonic vibration indicators and their use in the diagnosis of hydraulic-gas systems.
17. Describe the "ИКУ -1" principle of operation.
18. Indicate the signs of internal leakage of hydraulic-gas systems.
19. Characterize evaluation of internal leakage in hydraulic-gas systems.
20. List the causes of internal leaks in hydraulic-gas systems.
21. Describe the design and installation location of sensors for measuring the internal leakage of hydraulic-gas systems.
22. Write an equation that relates the electrical power of a thermistor and the characteristic of the flow of working fluid.
23. Describe the main operational criterion of internal leakage of hydraulic-gas systems.
24. Explain the definition of internal leaks by changing the angle of installation of the tilt washer in pumps of variable productivity.
25. Explain the definition of internal leakage of pumps of constant productivity.
26. Give the dependence of the output signal  $S_a$  of the thermistor on the speed  $V_p$  and temperature  $T_r$  of the working fluid.
27. Describe the differential magnetic method of diagnosing the technical condition of the gas turbine engine.
28. Explain what the term "friction" means.
29. Explain what is meant by the term "wear" of construction materials.
30. Give the criteria for assessing the wear of structural materials.

#### Tasks of the practical part

##### **2.1. Maintaining Airworthiness of Aircraft (ICAO Doc.9760)**

1. Explain what documentation is drawn up when performing work on the type of aircraft under study.
2. Name the rules, procedures and means of heating engines and systems.
3. Describe the structure of maintenance regulations.
4. Describe the general provisions, forms of work regulations on line maintenance.
5. Describe the general provisions, forms of work regulations on basic maintenance.
6. Name the means and rules for removing ice and snow.
7. Describe the work on the meeting of the aircraft: the list and order of execution, the functions of the performers.
8. Name the means, rules, procedures for air conditioning in the cabins.

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 11 of 19	

9. Give a description of the work on inspection and maintenance: the content of work, organization of work, control of work performance.
10. Explain the requirements for the technical condition of the airframe.
11. What operational factors affect the technical condition of the airframe.
12. Describe the work of providing flight.
13. Explain what the typical work is to repair the damage to the airframe.
14. Explain what methods of restoring an airframe technical condition.
15. What is used for lubrication, lubrication card, lubricants used, tools, rules.
16. What materials, equipment and tools are used in the maintenance of airframe?
17. What are the rules for disassembly and replacement of airframe units, engines and aircraft systems?
18. Describe the requirements for the technical condition of the landing gear: loads affecting the technical condition of the landing gear, typical inspection and maintenance work.
19. What are the peculiarities of engine replacement?
20. Name the factors that lead to the appointment of work on special maintenance.
21. What operational factors affect the starting process and engines parameters?
22. What are the main adjustments in the products of hydro-gas systems.
23. Explain what is the purpose of external and internal conservation of engines and systems.
24. What is the procedure for performing inspection and adjustment work
25. What are the main works on the inspection and maintenance of the control system?
26. What are the features of aircraft preparation for the autumn-winter and spring-summer seasons of operation?
27. Name the methods and tools for diagnosing the elements of the power plant.
28. Describe the operating conditions and maintenance of pipelines.
29. What are the features of special maintenance?
30. Describe the test schedules and control parameters of the engine's operation.

### 2.2. Methodology of Applied Research in the Field of Aviation Transport

1. Write an expression for the probability of the event  $p(x)$  and the frequency  $\bar{y}(x)$  of the event and explain how they differ.
2. Write an expression to determine the mathematical expectation of a random event  $m(x)$  and explain its components.
3. Write an expression to determine the variance of a random event  $D(x)$  and explain its components.
4. Write an expression to determine the mean square deviation of a random event  $\sigma(x)$  and explain its components.
5. Write an expression to determine the coefficient of variation of a random event  $k_\sigma$  and explain its components.
6. Determine the average value of a random variable  $\bar{X}$  from the proposed sample of random numbers (3, 5, 2, 7, 8, 5, 4, 3, 2, 6) and the deviation from the average value for each result.
7. Determine the probability of non-destruction of the tire of the main chassis, if the probability of its destruction is 0.07.
8. Determine the mathematical expectation  $m(x)$  for given values of a random variable and the probability of its occurrence:


9. Determine the variance  $D(x)$  for given values of a random variable and the probability of its occurrence:


10. Determine the mean square deviation  $\sigma(x)$  at given values of a random variable and the probability of its occurrence:


11. Determine the average value  $\bar{X}$  and mathematical expectation  $m(x)$  for the following sample:


12. Determine the scattering measure (variance  $D(x)$ ) for the following sample:


13. Determine the average deviation  $\sigma(x)$  and the coefficient of variation  $k_e$  if the variance  $D(x) = 0.83$  and the mathematical expectation  $m(x) = 2.95$  are known.

14. Determine the average value  $\bar{X}$  and mathematical expectation  $m(x)$  for the following sample:


15. Write an expression to determine the probability of a random event  $p(x)$  and explain its components.

16. Write an expression to determine the frequency of the event  $\bar{y}(x)$  and explain its components.

17. Determine the average value  $\bar{X}$  and mathematical expectation  $m(x)$  for the following sample:


18. Determine the average value of the random variable  $\bar{X}$  from the proposed sample of random numbers (1, 3, 2, 6, 2, 5, 4, 1, 3, 7) and the deviation from the average value for each result.

19. Determine the mathematical expectation  $m(x)$  for given values of a random variable and the probability of its appearance:


20. Determine the probability of destruction of the main landing gear tire, if the probability of non-destruction is 0.98.

21. Determine the deviation from the mean  $\bar{X}$  for each:


22. Determine the deviations from the mathematical expectation  $m(x)$  for each result:


23. Explain if the value of the variance of a random variable decreases, what does this mean.

24. It will determine the root mean square deviation  $\sigma(x)$  at given values of the random variable and the probability of its occurrence:


	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 13 of 19	

25. Write an expression to determine the standard deviation of a random variable.  
26. Determine the mathematical expectation  $m(x)$  for given values of a random variable and the probability of its occurrence:


27. Determine the deviation from the mean value  $\bar{X}$  for each result:


28. Determine the deviation from the mathematical expectation  $m(x)$  for each result:


29. Determine the average value  $\bar{X}$  and mathematical expectation  $m(x)$  for the following sample:


30. Determine the value of the standard deviation of a random variable as if it had the following values:


### 3. LIST OF REFERENCES

#### Primary literature:

1. Annex 8 to the Convention on International Civil Aviation: Airworthiness of Aircraft. 2018. – 216 p.
2. Standard and recommended practices. Airworthiness Manual. Doc. 9760 AN/967. 2018. – 420 p.
3. Повітряний Кодекс України, 2011 р. (редакція від 16.06.2022).
4. Наказ Державної авіаційної служби України від 06.03.32019 р. № 286 «Про затвердження правил України «Підтримання льотної придатності повітряних суден та авіаційних виробів, компонентів і обладнання та схвалення організацій і персоналу, залучених до виконання цих завдань».
5. Hamdy A. Taha Operations Research: An Introduction, University of Arkansas, Fayetteville, 2007. – 838 p.
6. Карагодова О. О. Дослідження операцій: [Навч. посіб.] / Карагодова О. О., Кігель В. Р., Рожок В. Д. – К.: ЦУЛ, 2007 – 256 с.
7. Зайченко Ю. П. Дослідження операцій: підручник / Зайченко Ю. П. – [7-е вид.]. – К.: ВД «Слово», 2006. – 816 с.
8. Чумак В. Л., Іванов С. В., Максимюк М. Р. Основи наукових досліджень: підручник – К.: НАУ-друк, 2009. – 304 с.
9. Підтримання льотної придатності повітряних суден (ICAO Doc. 9760): навч. посібник / С. О. Дмитрієв, О. В. Попов, В. О. Максимов, О. І. Духота, Є. Ю. Євсюков. – К.: НАУ, 2022. – 207 с.

#### Supporting literature:

1. Наконечний С. І. Математичне програмування: навч. посіб. / С. І. Наконечний, С. С. Савіна. – К.: КНЕУ, 2003 – 452 с.
2. Підручник Дослідника: навч. посібник / О. Васильковський, С. Лещенко, Д. Петренко. – Кіровоград: 2016. – 204 с.
3. Основи теорії надійності і техногенний ризик: практикум / уклад. О.О. Мікосянчик, Н.М. Кічата, І.В. Якимець, І.В. Матвєєва, К.В. Синило. – К.: НАУ, 2019. – 120 с.

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 14 of 19	

Information resources on the Internet:

1. <http://avia.gov.ua>
2. [www.easa.europa.eu](http://www.easa.europa.eu)
3. <https://www.icao.int/Pages/default.aspx>
4. <https://www.bazl.admin.ch/bazl/en/home/specialists/regulations-and-guidelines/legislation-and-directives/anhaenge-zur-konvention-der-internationalen-zivil-luftfahrt-organi.html#:~:text=The%20Convention%20on%20the%20International,of%20the%20international%20civil%20aviation>
5. <https://zakon.rada.gov.ua/laws/show/3393-17#Text>
6. <https://zakon.rada.gov.ua/laws/main/z0316-19>

#### 4. RATING SYSTEM FOR EVALUATING RESULTS OF PASSING THE CERTIFICATE EXAM

4.1 The Rating System for Evaluating (RSE) the results of acquired knowledge and skills based on the results of CE in the specialty of higher education holders of the master's degree, developed in accordance with the requirements of the Law of Ukraine "On Higher Education" No. 1156-VII dated 01.07.2014 (as amended), "Regulations on the attestation of higher education applicants of the National Aviation University", approved by the rector's order dated May 10, 2023 №193/од.

4.2 The RSE of the results of the acquired knowledge and skills based on the results of the CE according to the EPP is brought to the attention of the applicants, scientific and pedagogical workers, the chairman and members of the EC.

4.3 Attestation of master's degree holders under the conditions of the credit-module system is carried out in the EC by means of a rating evaluation of the results of CE tasks by specialty using a final rating evaluation.

4.4 The final rating evaluation of the results of the evaluation of the results of the preparation of CE according to the EPP in points is defined as the average arithmetical evaluation of the rating evaluations of the chairman and members of the EC, based on a 100-point scale with its subsequent transfer to an evaluation according to the national scale and the ECTS scale (table 1).

Table 1

Performance evaluation scale  
of exam ticket tasks

Rating in points	Rating on a national scale	Rating according to the ECTS scale
90-100	Excellent	A
82-89	Good	B
75-81		C
67-74	Satisfactorily	D
60-66		E
35-59	Unsatisfactorily	FX
1-34		F

4.5 The final rating evaluation with ET according to the EPP is defined as the sum of the evaluations for completing the tasks of the theoretical and practical parts.

4.5.1 Ratings for the performance of each ET task are given in points taking into account the relevant criteria (tables 2, 3).

	<b>Quality Management System Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 15 of 19	

Table 2

Evaluation of the performance of individual certification exam tasks

Type of academic work	Maximum number of points	Evaluation criteria for the results of individual tasks	The content of the evaluation criteria for the results of the individual tasks	Rating in points	Rating in points
<b>Theoretical part</b>		1. Correspondence of the results of the answers to the questions	- fully responds	5	2,5
Question 1	20		- does not fully respond	4	2
Question 2	20		- does not answer enough	3	1
Question 3	20				
Question 4	20				
<b>Total for the theoretical part</b>	<b>80</b>	2. Completeness and degree of validity of answers	- full enough	5	2,5
			- not full enough	4	2
			- incomplete and unsubstantiated	3	1
<b>Practical part</b>		3. Presence of creative thinking elements	- available elements of creativity	5	2,5
Task 1	10		- typical (standard) solution	4	2
Task 2	10		- lack of creativity	3	1
<b>Total for the practical part</b>	<b>20</b>	4. Ability to teach material professionally, logically, consistently	- quite logical and consistent	5	2,5
			- not consistent and logical enough	4	2
			- inconsistent and illogical	3	1
<b>Total for CE</b>	<b>100</b>				

Table 3

 Correspondence of rating grades  
 for the performance of individual tasks of the examination ticket in points  
 to grades on the national scale

Rating in points		Rating on a national scale	Explanation
18-20	9-10	Excellent	Excellent performance with insignificant shortcomings
16-17	8	Good	Performance above the average standard with few mistakes
15	7,5		In general, correct performance with a certain number of significant errors
13-14	7	Satisfactorily	Not a bad performance, but with a significant amount of flaws
12	6		Implementation meets minimum
under 12	under 6	Unsatisfactorily	Performance does not meet minimum criteria

4.5.2 The rating for the completion of the first part of the examination ticket (ET) tasks consists of the sum of points for the completion of its 4 tasks. The rating for the completion of the second part of the ET consists of the sum of the points for the completion of its two tasks. Assessments for the performance of each part of the examination ticket are determined in points and on a national scale according to table 4.

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b> Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	Code of document	QMS NAU CEP 07.06 – 03–2023
		page 16 of 19	

Table 4

Correspondence of the rating evaluations for the performance of the tasks of the examination ticket in points to the evaluations on the national scale

Part 1	Part 2	Rating on a national scale
72 – 80	18 – 20	Excellent
60 – 71	15 – 17	Good
48 – 59	12 – 14	Satisfactorily
under 36	under 24	Unsatisfactorily

4.5.3 Rating scores for the performance of each part of the examination ticket, as well as the final rating score for the performance of the ET, are entered in the Minutes of the EC meeting (an example of filling out the Minutes is given in Table 5).

Table 5

An example of filling out the minutes of the meeting of the EC on the implementation of CE

Serial number	Surname of the recipient	Task option	Rating		
			Part 1	Part 2	Final
			72/ <i>Відм.</i>	18/ <i>Відм.</i>	90/ <i>Відм./A</i>
			56/ <i>Задов.</i>	17/ <i>Добре</i>	73/ <i>Задов./D</i>
			72/ <i>Відм.</i>	12/ <i>Задов.</i>	84/ <i>Добре/B</i>
			55/ <i>Задов.</i>	20/ <i>Відм.</i>	75/ <i>Добре/C</i>

4.5.4 Only the final rating based on the results of the CE is entered into the individual study plan of the student, for example, so *90/Відм./A*.

4.5.5 In the event that the applicant is absent from CE for any reason, or receives an "Unsatisfactory" grade (according to the national scale), the issue of the student's further education is resolved in accordance with the established procedure.

## 5. LIST OF REFERENCE SOURCES OF INFORMATION THAT ARE ALLOWED TO BE USED DURING THE CERTIFICATION EXAM

5.1. Maintenance regulations and technological instructions for the performance of scheduled work on aircraft by type.

5.2 Order of the State Aviation Administration of March 6, 2019 No. 286 On the approval of the Aviation Rules of Ukraine "Maintaining the airworthiness of aircraft and aviation products, components and equipment and approval of organizations and personnel involved in the performance of these tasks".

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b> Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	Code of document	QMS NAU CEP 07.06 – 03–2023
		page 17 of 19	

(Ф 03.02-114)

NATIONAL AVIATION UNIVERSITY

Aerospace Faculty  
Aircraft Continuing Airworthiness Department  
Field of Study: 27 Transport  
Specialty: 272 Air Transport  
Educational Professional Program: **Maintenance and Repair of Aircrafts and Aircraft Engines**  
Educational qualification: **Master in Aviation Transport**

**EXAMINATION TICKET № \_\_\_\_\_**

**Theoretical part**

- 1.
- 2.
- 3.
- 4.

**Practical part**

- 1.
- 2.

Approved at a meeting of the Aircraft Continuing Airworthiness Department,  
Minutes № \_\_\_\_\_ of " \_\_\_\_\_ " \_\_\_\_\_ 20\_\_\_\_.

Head of the Department

\_\_\_\_\_ Oleksandr POPOV

	Quality Management System <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 18 of 19	

(Φ 03.01–24)

NATIONAL AVIATION UNIVERSITY

**LETTER FOR THE PREPARATION OF ANSWERS FOR THE EXAM**

Aerospace Faculty  
Aircraft Continuing Airworthiness Department  
Field of Study: 27 Transport  
Specialty: 272 Air Transport  
Educational Professional Program: **Maintenance and Repair of Aircrafts and Aircraft Engines**  
Educational degree: **Master**

Recipient \_\_\_\_\_ course \_\_\_\_\_ group \_\_\_\_\_  
First Name Last Name (date)

EXAMINATION TICKET № \_\_\_\_\_

	<b>Quality Management System</b> <b>Certification exam program</b> for applicants of a <b>master's degree</b>	Code of document	QMS NAU CEP 07.06 – 03–2023
	Field of Study: 27 Transport Specialty: 272 Air transport Educational Professional Program: "Maintenance and Repair of Aircrafts and Aircraft Engines"	page 19 of 19	

(Ф 03.02 – 01)

## АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки

(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				