OLYMPIAD "I AM A MASTER" FOR APPLICANTS TO THE MASTER'S PROGRAM

25.04.01 Technical operation of aircraft and engines

METHODOLOGICAL RECOMMENDATIONS FOR TRAINING

TO THE QUALIFYING STAGE OF THE OLYMPIAD

2025/2026 ACADEMIC YEAR

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QUALIFYING STAGE

The selection stage of the Olympiad "I am a Master" for applicants to the Master's program (hereinafter referred to as the Olympiad) in the direction of training (program) 25.04.01 Technical operation of aircraft and engines is held remotely.

Task questions are compiled for each participant individually in automatic mode. Each version of the Olympiad work of the qualifying stage includes tasks that assume that the participants of the Olympiad are prepared within the framework of the Federal State Educational Standard.

1 (one) astronomical hour (60 minutes) is allocated for solving the problems of the qualifying stage of the Olympiad. The countdown starts from the start of completing tasks. The place and time of completing tasks are determined by the participants themselves. To complete tasks, you need a computer with Internet access. The Organizing Committee is not responsible for power and communication failures when solving the problems of the qualifying round.

A participant of the Olympiad performs tasks of the qualifying stage once. The tasks of the qualifying stage include 2 blocks of questions. For each correct answer of 1 block, the participant receives 2 points; for each correct answer of 2 blocks – 2 points. The maximum possible number of points scored by a participant is 100.

The Olympiad tasks of the qualifying round include content elements from the following course 25.03.01 Technical operation of aircraft and engines:

1 section "Aircraft construction";

2 section "Reliability of aviation equipment";

Various methods of presenting information in the task texts (graphs, tables, diagrams, and schematic drawings) were used to construct variants of the Olympiad work of the qualifying stage.

The first block contains tasks in the form of 38 test questions and a practical task.

The second block contains 12 test questions and a practical task.

The participant of the Olympiad receives a version of the Olympiad work of the qualifying stage, consisting of 50 questions and two practical tasks.

Each task is evaluated depending on the level of difficulty and correctness of the result obtained. The points received by the participant of the Olympiad for completed tasks are summed up.

LIST OF CONTENT ELEMENTS INCLUDED IN THE TASKS OF THE OLYMPIAD OF THE QUALIFYING STAGE OF THE 2025/2026 ACADEMIC YEAR

SECTION 1. "Aircraft construction".

In general, the section "Aircraft Design" studies the design, construction and operation principles of various types of aviation equipment, including airplanes, helicopters, drones and other aircraft. The main areas of study include:

1. Classification of aircraft
 - Types of aircraft (civil, military, experimental)
 - Classification of helicopters and other types of aircraft
2. Aerodynamic design basics
 - Streamlined fuselage, wing and tail
 - Influence of shape and materials on aerodynamic drag
3. Structural elements of the aircraft
 - Fuselage: construction, materials, protection systems
 - Wing: profile, mechanization, power structure
 - Tail unit: stabilizers, elevators and rudders
 - Chassis: chassis types, clean-up and exhaust mechanisms, shock-absorbing systems
4. Aircraft control system
 - Steering surfaces and flight control system
 - Electronic flight control systems (Fly-by-wire)
5. Aircraft engines and power plants
 - Turbojet engines, turboprop and reciprocating engines
 - Engine design and operation
6. Materials and production technologies
 - Metals, composites, polymers and other modern materials
 - Technologies for assembling and processing structures
7. Operation and maintenance
 - Maintenance regulations
 - Fault diagnosis and structural repairs
8. Flight safety and certification
 - Certification requirements for aircraft structures
 - Analysis of accidents and structural failures

Example of a question.

The main flight control surfaces are:

A. Flaps

B. Ailerons

B. Spoilers

When completing test tasks, one correct option is selected from the suggested answers. It is important to remember that the correct answer is the only one. So, in the given example, the correct option is " B. Ailerons".

When performing a practical task, you should pay attention to the fact that, during photographing, the frame is scanned very quickly in the direction from left to right (from the photographer's point of view). In this case, the "scan line" also moves at a constant speed from left to right. Scanning the entire image takes 1/8 of a second.

You must start performing the task in the sequence specified in the ticket.

1. In what direction does the propeller rotate from the photographer's point of view?
2. How many blades does a propeller have?
3. How many revolutions per second does the propeller make if the whole image scanning process takes 1/8 of a second?

SECTION 2. "Reliability of aviation equipment".

Reliability of aviation technology is a discipline that studies the patterns, methods and means of ensuring the stable and safe operation of aviation systems and devices during their operation.

The main content of the discipline includes:

- Determination and analysis of reliability indicators — uptime probabilities, average operating time to failure, maintainability, survivability, and safety.
- Methods of forecasting and evaluating the reliability of aviation equipment at different stages: design, production, operation.
- Diagnostics and control of the technical condition of aircraft and their systems to prevent failures.
- Organization of maintenance and repair in order to maintain a given level of reliability.
- Study of the causes of failures and emergencies, methods of their prevention.
- Application of statistics, probability theory and engineering calculations to improve the reliability of aviation equipment.

Example of a question.

Many diagnostic tasks are solved on the basis of:

A) probability theory

B) reliability theories

C) technical forecasting

When completing test tasks, one correct option is selected from the suggested answers. It is important to remember that the correct answer is the only one. So, in the given example, the correct option is "B) reliability theory".

When performing a practical task, you should pay attention to the use of the structural reliability method.

The structural reliability method (the method of structural reliability schemes) is a method for calculating the reliability indicators of technical systems based on

the representation of an object in the form of a structural diagram. The following structural reliability schemes can be used:

structural flowcharts of reliability;

bounce trees.

graphs (diagrams) of states and transitions.

The essence of the method

This method allows you to:

Analyze logical relationships between the states of elements and the object as a whole, taking into account structural and functional relationships, interaction of elements, the adopted maintenance strategy, types and methods of redundancy, and other factors.

Calculate object reliability indicators based on data on the reliability of its elements in the considered application conditions.

The purpose of the method is to identify bottlenecks in the system design from the point of view of reliability, and at the design stage to develop constructive measures to eliminate such bottlenecks.

Algorithm

Calculation of reliability indicators by structural methods generally includes:

Representation of an object as a block diagram.

Description of the constructed scheme by an adequate mathematical model that allows calculating the object's reliability indicators within the framework of the entered assumptions and assumptions.

Calculations are usually performed under the assumption that the entire system and each of its elements can only be in one of two possible states — operational and inoperable, and the failures of elements are independent of each other.

Examples

Calculation of the reliability of a system with a serial connection of elements. Failure of at least one element causes the entire object to fail. The uptime probability of a system is defined as the product of the uptime probabilities of individual elements.

Calculation of reliability of multifunctional systems. Usually, the probability of system uptime is determined for each function separately, and each function often has its own reliability block diagram.

Regulatory and technical documentation

The use of the structural diagram method for calculating the reliability of technical systems is regulated by GOST R IEC 61078-2021-the national standard of the Russian Federation " Reliability in engineering. Block diagram of reliability". The standard is identical to the international standard IEC 61078: 2016 "Block diagram of reliability".

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