

Документ подписан простой электронной подписью
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Дата подписания: 22.10.2026 13:25:38
Уникальный программный ключ:
990bea3aeec48c23bd8699e48288f8d1960c600

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution
Higher Education
"NORTH CAUCASUS FEDERAL UNIVERSITY"

APPROVED BY
Acting Director of the Institute
Advanced Engineering
A.A. Porokhnya

DISCIPLINE ASSESSMENT TOOLS FUND
"Sensor and Detection Technology"

Field of study	11.03.02 Infocommunication Technologies and Communication Systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of start of training	2026
Form of study	Full-time
Implemented in a semester	5

Introduction

1. Purpose

The fund of assessment tools for the discipline "Sensor and Detection Technology" is designed for an objective assessment of the level of competence formation.

2. FOS is an appendix to the program of the discipline "Sensor and Detection Technology".

3. Developer S. V. Yakovlev, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

4. An examination of the FOC was carried out.

Members of the expert group:

Chairman: N.Y. Bratchenko, Chairman of the CMT of the Institute of Advanced Engineering, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

Members of the Commission:

V. P. Mochalov, Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

S. V. Melnikov, Senior Researcher at the Interdisciplinary Educational and Research Center for Agricultural Technologies, Associate Professor of the Department of Digital, Robotic Systems and Electronics of the Institute of Advanced Engineering.

Representative of the employer's organization:

Mironov V.A., General Director of Orintex LLC.

Expert opinion: The FAT for the discipline allows you to assess the level of competence formation. Start approbation.

5. The validity period of the FAT is determined by the period of implementation of the educational program.

1. Description of the criteria for assessing competence at various stages of their formation, description of assessment scales

Competence(s), indicator(s)	Levels of competence formation(s),			
	The minimum level has not been reached (unsatisfactory) 2 points	Minimum level (satisfactory) 3 points	Intermediate level (good) 4 points	High level (excellent) 5 points
OPK-4				
Learning outcomes in the discipline (module): <i>Indicator:</i> ID-1 OPK-4 uses information and communication technologies when searching for the necessary information.	based on an understanding of the general principles of the functioning of robotic sensors, is not able to determine the architecture of robotic sensors and install and configure the software of robotic sensors	Based on the understanding of the general principles of the functioning of robotic sensors, he is able to determine the architecture of robotic sensors with some errors and install and configure the software of robotic sensors	based on an understanding of the general principles of robotic sensor functioning, is able to correctly determine the architecture of robotic sensors and install and configure the software of robotic sensors	Based on an understanding of the general principles of the functioning of robotic sensors, he is able to competently determine the architecture of robotic sensors and install and configure the software of robotic sensors
Learning outcomes in the discipline (module): <i>Indicator:</i> ID-2 OPK-4 designs a solution to a specific project task, choosing the best way to solve it, based on the current legal norms and available resources and restrictions.	does not understand the technology of developing and debugging robotic sensors, including the use of cross-platform programming	understands with some mistakes the technologies for the development and debugging of robotic sensors, including the use of cross-platform programming	understands technologies for the development and debugging of robotic sensors, including the use of cross-platform programming	fully understands the technologies for the development and debugging of robotic sensors, including the use of cross-platform programming
Learning outcomes in the discipline (module): <i>Indicator:</i> ID-3 OPK-4 understands modern interactive software systems and basic methods of processing experimental data, including the use of standard software, general-purpose and special-purpose software packages	Does not work with programmable logic controllers. It does not carry out software and hardware configuration of robotic sensors.	Partially works with programmable logic controllers. It is difficult to carry out software and hardware configuration of robotic sensors.	Works with programmable logic controllers. Carries out software and hardware configuration of robotic sensors.	Works independently with programmable logic controllers. It actively carries out software and hardware configuration of robotic sensors.

Learning outcomes in the discipline (module): <i>Indicator:</i> ID-4 OPK-4 uses the capabilities of computer technology and software to solve problems of control and algorithmization of information processing processes.	Does not create flowcharts of algorithms for the functioning of the developed software products.	Partially creates flowcharts of algorithms for the functioning of the developed software products.	Creates flowcharts of algorithms for the functioning of the developed software products.	Independently and creates flowcharts of algorithms for the functioning of the developed software products.
Learning outcomes in the discipline (module): <i>Indicator:</i> ID-5 OPK-4 is proficient in methods of computer modeling of physical processes in the transmission of information, engineering and computer graphics techniques.	Does not assess the computational complexity of the software products being developed	Partially assesses the computational complexity of the developed software products	Evaluates the computational complexity of the software products being developed	Independently assesses the computational complexity of the developed software products

Assessment of the level of competence in the discipline is carried out on the basis of the "Regulation on the current monitoring of progress and intermediate certification of students in educational programs of higher education - bachelor's programs, specialist programs, master's programs - in the Federal State Autonomous Educational Institution of Higher Education "North Caucasus Federal University" in the current edition.

ASSESSMENT TOOLS FOR CHECKING THE LEVEL OF COMPETENCE FORMATION

Job Number	Correct answer	Content of the question	Competence
Semester 5			
1.	a d e f	Which of the following refers to the elements of the functional diagram of the information and measurement system a) Sensitive Device b) Conveyor Line c) Regeneration section d) Amplifier-converter e) Communication system f) Receiver	OPK-4
2.	Transducer	Enter the missing word in the right case. A sensor is a primary _____ that reacts to the quantity to be detected (temperature, pressure, displacement, current, etc.).	OPK-4
3.	signal	Enter the missing word in the right case. The converter amplifier amplifies the primary _____ produced by the sensitive device and converts it into the most convenient form for further use.	OPK-4
4.	information	Enter the missing word in the right case. Depending on the purpose of the system, the receiving device can serve to transmit the received _____ to some technical system of control, control, etc.	OPK-4
5.	Displacement	Enter the missing word in the right case. According to the principle of operation, _____ sensors are divided into resistive, electromagnetic, photoelectric and capacitive.	OPK-4
6.	a d	Which of the following refers to the types of displacement sensors a) linear	OPK-4

		b) high-speed c) Accelerator d) Corner	
7.	Potentiometer	Enter the missing word in the right case. Resistive displacement sensors are _____ with a motor, the displacement of which is the primary detectable quantity that is converted into resistance.	OPK-4
8.	a b	Which of the following refers to the types of electromagnetic displacement sensors a) Inductive b) transformer c) autotransformer d) hollow	OPK-4
9.	mutual	Enter the missing word in the right case. Transformer displacement sensors convert the detected quantity into a change in the induction _____ coefficient.	OPK-4
10.	Tanks	Enter the missing word in the right case. Capacitive displacement sensors convert the detected displacement into the value of the capacitor _____ by changing the distance between the capacitor plates (electrodes).	OPK-4
11.	Strain resistive	Enter the missing word in the right case. _____ sensors are based on changing the resistance of conductors or semiconductors during deformation and then converting it into an electrical signal.	OPK-4
12.	Direct	Enter the missing word in the right case. Piezoelectric acceleration sensors are based on _____ piezoelectric effect.	OPK-4
13.	1-b 2-a 3-c	Establish a match: 1) Systems that give a general picture of the environment with the subsequent identification of its individual objects	OPK-4

		2) Systems that determine various physical and chemical properties of the external environment and its specific objects 3) Systems that determine the coordinates of the robot's location and the parameters of its movement a) Meters of geometric parameters, density, temperature, optical properties, chemical composition, etc b) Vision systems c) Systems that define parameters related to the robot itself	
14.	kilometers	Enter the missing word in the right case. Laser rangefinders are used at ranges of up to several _____.	OPK-4
15.	Gyroscopic	Enter the missing word in the right case. _____ systems are designed to determine the angular position of objects in a gravitational field.	OPK-4
16.	b c	Which of the following refers to the types of optical gyroscopes a) Vibrational b) Fiber optic c) Laser d) Corner	OPK-4
17.	Three	Enter the missing word in the right case. The inertial measurement system should include _____ orthogonal accelerometers and _____ orthogonal gyroscopes.	OPK-4
18.	magnetometers	Enter the missing word in the right case. The main types of _____ are magnetostatic, induction, Hall effect and quantum.	OPK-4
19.	1-c 2-b	Establish a match: 1) Magnetostatic magnetometers	OPK-4

	3-a	2) Induction magnetometers 3) Fluxgate magnetometers a) are based on a periodic change in the magnetic resistance of the measuring coil by moving the permalloy core or changing its magnetic permeability by an alternating excitation field b) are based on the measurement of EMF arising in a measuring coil rotating or vibrating in a magnetic field c) are based on the measurement of the mechanical moment acting on the indicator magnet in a magnetic field	
20.	Wednesday	Enter the missing word in the right case. The _____ model is built in the form of a map of the area and a plan of the premises inside the buildings.	OPK-4
21.	a c e	Which of the following refers to the elements of the computer vision system a) Image sensor b) optical fiber c) Pre-treatment device d) Protractor e) Processor	OPK-4
22.	a c e	Which of the following refers to the main characteristics of the image sensor a) Length b) Resolution c) Sensitivity d) Spectral Response e) Number of cores	OPK-4
23.	c a e b	Establish the correct sequence of visual processing tasks in vision systems: a) Segmentation b) Recognition c) Pre-processing of the video image received from the sensor	OPK-4

		d) Cable Laying e) Determination of the characteristics of individual objects f) Installation work	
24.	Safety	Enter the missing word in the right case. When controlling the movement of mobile robots, computer vision systems must provide a solution to two tasks - navigation and movement _____.	OPK-4
25.	1-a 2-b	Establish a match: 1) In the course of solving navigation problems when controlling the movement of mobile robots, computer vision systems should 2) In the course of solving the problems of ensuring traffic safety when controlling the movement of mobile robots, computer vision systems should a) to form a video picture (plan) of the external environment within sight b) Ensure that obstacles are detected and overcome or avoided	OPK-4
26.	c d e	Which of the following applies to the specific requirements for vision systems a) virtuality b) Solvability c) Versatility d) Real-time operation e) Miniaturization of image sensors	OPK-4
27.	filtration	Enter the missing word in the right case. The _____ operation in the pre-processing device of the image received from video cameras is carried out using linear low-pass filters and nonlinear filters that suppress impulse interference	OPK-4
28.	contrast	Enter the missing word in the right case. The _____ operation in the pre-processing device of the image received from video cameras is to equalize the brightness of the image elements	OPK-4

29.	binarization	Enter the missing word in the right case. The _____ operation in the pre-processing device of the image received from video cameras is the conversion of the original grayscale image into a two-gradation (black and white) one, which allows you to dramatically reduce the amount of original video information	OPK-4
30.	Path Selection	Enter the missing word in the right case. The _____ operation in the pre-processing device of the image received from video cameras is the determination of the outlines of individual objects and homogeneous areas of the environment in the form of boundaries of a jump change in brightness	OPK-4
31.	a c d	Which of the following refers to the approaches to solving the problem of pattern recognition in computer vision systems a) Comparison of the image of the object with the reference one b) Increase image resolution c) Analysis of characteristic features d) Structure Analysis e) Miniaturizing Image Size	OPK-4
32.	benchmark	Enter the missing word in the right case. In image recognition in computer vision systems, comparing the image of an object with _____ consists of combining the image of the recognized object with the sample by rotating, scaling, and moving	OPK-4
33.	Signs	Enter the missing word in the right case. In pattern recognition in computer vision systems, the analysis of characteristic _____ is based on the transition from the initial image to a set of descriptors characterizing it, according to which recognition is carried out.	OPK-4
34.	Structures	Enter the missing word in the right case. In pattern recognition in computer vision systems, _____ analysis is based on a structural description of patterns	OPK-4

35.	b c	Which of the following refers to the main tasks in the synthesis of collective recognition systems in computer vision systems: a) Selection of working documentation b) Selection of classifiers c) Choosing an output solution d) Selecting Resources e) Selection of similar objects	OPK-4
36.	Regulations	Enter the missing word in the right case. In general, to control manipulators, it is necessary to use two types of information - about the _____ of the working body and about the strength of its interaction with objects of the environment.	OPK-4
37.	Powers	Enter the missing word in the right case. The _____ sensors in the force sensing system provide primary information about the force (moment).	OPK-4
38.	a c f	Which of the following refers to the main options for placing force-torque sensors on the manipulator: a) in manipulator hinges b) on the server c) at the working body d) on the nearest obstacle e) on the floor surface f) directly on the screed	OPK-4
39.	observers	Enter the missing word in the right case. When controlling manipulators, along with devices for direct force determination, various indirect methods of force estimation are also used with the help of computing devices, the so-called _____.	OPK-4
40.	degrees	Enter the missing word in the right case.	OPK-4

		Force sensing of robot manipulators is required primarily to provide a positional-force method of controlling its _____ mobility.	
41.	Sensing	Enter the missing word in the right case. When controlling the manipulator with the help of the master handles, a human operator is required to provide a power _____ for these handles.	OPK-4
42.	b e f	Which of the following refers to the type of interface in a multi-sensor information and measurement system: a) Resource b) Analog c) Project d) interconnected e) Digital Duplex f) Digital Networking	OPK-4
43.	b c f	Which of the following refers to digital duplex interfaces in a multi-sensor information and measurement system: a) MIL-STD-1553 b) RS-232 c) RS-485 d) CAN e) Ethernet f) ARINC 429	OPK-4
44.	a d e	Which of the following refers to digital network interfaces in a multi-sensor information and measurement system: a) MIL-STD-1553 b) RS-232 c) RS-485 d) CAN e) Ethernet f) ARINC 429	OPK-4

45.	b d a e c	Establish the correct sequence of levels of integration in sensor systems: a) Object images b) Primary sensory information c) Symbols (concepts) d) Elements of sensory information e) verbal signs highlighted by sensory systems	OPK-4
46.	External	Enter the missing word in the right case. Sensors _____ the environment include: ultrasonic and laser rangefinders and locators; technical stereovision system, contact and non-contact proximity sensors.	OPK-4
47.	Destinations	Enter the missing word in the right case. _____ sensors (heading sensors) include: gyroscope; digital magnetic compass.	OPK-4
48.	Locations	Enter the missing word in the right case. _____ and orientation sensors include: inclinometers, accelerometers, odometers, satellite navigation systems. _____ media sensors include: ultrasonic and laser rangefinders and locators; technical stereovision system, contact and non-contact proximity sensors.	OPK-4
49.	internal	Enter the missing word in the right case. Sensors _____ status and control systems include: temperature sensors, speed sensors, etc.	OPK-4
50.	inertial	Enter the missing word in the right case. Navigation sensors and sensors form a strapdown _____ navigation system, complemented by a satellite positioning system.	OPK-4

2. Description of the rating scale

Students' progress in each discipline is assessed during current control and intermediate certification.

3. Criteria for assessing competencies*

An "excellent" grade is given to a student if he has deeply and firmly mastered the program material, exhaustively, consistently, clearly and logically presents it, is able to closely link theory with practice, freely copes with tasks and questions not only of the basic, but also advanced level, and does not find it difficult to answer when modifying the tasks, correctly justifies the decision made, has versatile skills and techniques for performing practical tasks.

A grade of "good" is given to a student if he knows the material firmly, presents it competently and to the point, avoiding significant inaccuracies in answering questions of the basic level, correctly applies theoretical provisions when solving practical issues and tasks of the basic level, has the necessary skills and techniques for their implementation.

A "satisfactory" grade is given to a student if he has knowledge of only the basic material of the basic level, but has not mastered its details, makes inaccuracies, insufficiently correct formulations, violations of the logical sequence in the presentation of the program material, has difficulties in solving problems of the basic level.

The grade "unsatisfactory" is given to a student who does not know a significant part of the program material, makes gross mistakes, and does not know how to solve practical problems.