

Ministry of Science and Higher Education of the Russian Federation
NATIONAL RESEARCH
TOMSK STATE UNIVERSITY (NR TSU)

Institute of Applied Mathematics and Computer Science

APPROVE

Director of the Institute of Applied
Mathematics and Computer Science

A.V. Zamyatin

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Evaluation materials of the current control and intermediate certification of the
Research Work & Research Topics
(educational practice)

in the major of training

01.04.02 Applied mathematics and informatics

Orientation (profile) of training:

Big Data and Data Science

ET were implemented:

Dr. tech. sciences, professor,

Professor of the Department of Theoretical Foundations
of Computer Science



Yu.L. Kostyuk

Ph.D. physics and mathematics sciences, Associate Professor,

Associate Professor of the Department
of Applied Mathematics



E.Yu. Danilyuk

Ph.D. physics and mathematics Sciences, Associate Professor,

Associate Professor of the Department
of Applied Informatics



A.S. Morozova

Ph.D. physics and mathematics sciences,

Associate Professor of the Department of Theoretical Foundations
of Computer Science



O.V. Romanovich

Reviewer:

Dr. tech. sciences, professor,

Head of the Department of Theoretical Foundations
of Computer Science



A.V. Zamyatin

Evaluation tools were approved at a meeting of the educational and methodological commission
of the Institute of Applied Mathematics and Computer Science (EMC IAMCS).

Protocol dated 12.05.2022 № 4

Chairman of the EMC IAMCS,
Dr. tech. sciences, Professor



S.P. Sushchenko

Evaluation tools (ET) are an element of the system for assessing the formation of competencies among students in general or at a certain stage of its formation.

The ET is developed in accordance with the work program (WP) of the discipline.

1. Competencies and training outcomes, obtained upon the discipline mastery

Competencies	Competence indicator	Code and name of planned training outcomes that characterize the stages of competency formation	Criteria for evaluating training outcomes			
			Unsatisfactory	Satisfactory	Good	Excellent
UK-2 Able to manage a project at all stages of its life cycle	ICP - 2.1 Formulates the goal of the project, substantiates its significance and feasibility	OR-1. Know: research methods	Lack of knowledge	Generally successful but not systematical ly implemented knowledge	Generally successful knowledge, but accompanied by some errors	Formed knowledge
		OR-2. Be able to: formulate the purpose and specific objectives of scientific research.	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-3. Be able to: select and analyze alternative project options to achieve intended results.	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	ICM - 2.2 Develops an action program to solve project problems, taking into account available resources and limitations.	OR-1. Know: methods for assessing project effectiveness, as well as resource requirements.	Lack of knowledge	Generally successful but not systematical ly implemented knowledge	Generally successful knowledge, but accompanied by some errors	Formed knowledge
		OR-2. Be able to: draw up an individual practice plan.	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill

		OR-3. Possess: the skills of conducting a primary analysis of theoretical sources and achieved results on a similar problem and topic of research.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
	ICP - 2.3 Ensures project implementation in accordance with established goals, deadlines and costs.	OR-1. Possess the skills to develop projects in the chosen professional field in accordance with established goals, deadlines and costs.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
UK-4 Able to use modern communication technologies, including in a foreign language, for academic and professional interaction	IUC-4.1 Justifies the choice of current communication technologies (information technology, moderation, mediation, etc.) to ensure academic and professional interaction	OR-1. Be able to: justify the choice of current communication technologies	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IUC-4.2 Uses modern means of communication to improve the efficiency of academic and professional interaction, including in a foreign language	OR-1. Own: modern means of communication	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
	IUC-4.3 Evaluates the effectiveness of the use of modern communication technologies in academic and professional interactions	OR-1. Be able to: evaluate the effectiveness of the use of modern communication technologies in academic and professional interactions	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill

UK-5 Able to analyze and take into account the diversity of cultures in the process of intercultural interaction	IUC-5.1 Identifies, compares, typologizes the uniqueness of cultures to develop a strategy for interaction with their carriers	OR-1. Be able to: identify, compare, typologize the uniqueness of cultures to develop a strategy for interaction with their carriers	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IUC-5.2 Organizes and moderates intercultural interaction	OR-1. Be able to: organize and moderate intercultural interaction	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
UK-6 Able to determine and implement the priorities of one's own activities and ways to improve them based on self-assessment	IUC-6.1 Develops a strategy for personal and professional development based on correlating one's own goals and capabilities with the development of the chosen field of professional activity.	OR-1. Be able to: determine the basic principles of professional and personal development, based on the stages of career growth and labor market requirements.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Be able to: identify ways to improve your activities based on self-assessment.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IUC -6.2 Implements and adjusts the strategy of personal and professional development taking into account the conditions and prospects for the development of the labor market.	OR-1. Possess: the skills to solve problems of your own professional and personal development, including problems of changing your career trajectory; prioritize.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession

	IUC -6.3 Evaluates the results of implementing the strategy of personal and professional development based on analysis (reflection) of one's activities and external judgments.	OR-1. Be able to: carry out self-assessment in order to improve your educational activities.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Possess: ways to manage your cognitive activity and improve it based on self-esteem and the principles of lifelong education.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
OPK-1 Capable of solving current problems of fundamental and applied mathematics	IOPK-1.1 Analyzes problems in the field of fundamental and applied mathematics.	OR-1. Possess: skills in constructing mathematical and information models of processes and phenomena related to the object under study	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
		GPC-1.1.2 Be able to: apply scientific approaches in practical standard professional activities	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IOPK-1.2 Formulates the research objectives.	OR-1. Be able to: apply scientific approaches in practical standard professional activities.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Possess: the skills of conducting a primary analysis of theoretical sources and achieved results on a similar problem in the field of fundamental and applied mathematics.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession

	<p>IOPK-1.3 Solves current problems of fundamental and applied mathematics.</p>	<p>OR-1. Know: scientific approaches to solving non-standard problems of professional activity.</p>	<p>Lack of knowledge</p>	<p>Generally successful but not systematically implemented knowledge</p>	<p>Generally successful knowledge, but accompanied by some errors</p>	<p>Formed knowledge</p>
		<p>OR-2. Be able to: Solve current problems of fundamental and applied mathematics.</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>
<p>OPK-2 Capable of improving and implementing new mathematical methods for solving applied problems</p>	<p>IOPK-2.1 Uses the results of applied mathematics to master and adapt new methods for solving problems in the area of their professional interests.</p>	<p>OR-1. Be able to: justify the choice of modern intelligent technologies and software environment when developing original software tools for solving professional problems.</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>
		<p>OR-2. Possess: the skills of using the results of applied mathematics to master and adapt new methods for solving problems in the area of one's professional interests.</p>	<p>Lack of ownership</p>	<p>Generally successful but not systematically pursued possession</p>	<p>Generally successful, but accompanied by some errors, ownership</p>	<p>Formed possession</p>
	<p>IOPK-2.2 Implements and improves new methods for solving applied problems in the field of professional activity</p>	<p>OR-1. Own: new methods and solutions to applied problems</p>	<p>Lack of ownership</p>	<p>Generally successful but not systematically pursued possession</p>	<p>Generally successful, but accompanied by some errors, ownership</p>	<p>Formed possession</p>
		<p>OR-2. Be able to: improve new methods and solutions to applied problems</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>

	IOPK-2.3 Conducts qualitative and quantitative analysis of the resulting solution in order to construct the optimal option	OR-1. Be able to: conduct qualitative and quantitative analysis of the resulting solution in order to construct the optimal option	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
OPK-3 Able to develop mathematical models and analyze them when solving problems in the field of professional activity	IOPK-3.1 Develops mathematical models in the field of applied mathematics and computer science	OR-1. Be able to: develop mathematical models in the field of applied mathematics and computer science	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IOPK-3.2 Analyzes mathematical models for solving applied problems of professional activity	OR-1. Be able to: analyze mathematical models to solve applied problems	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IOPK-3.3 Develops and analyzes new mathematical models for solving applied problems of professional activity in the field of applied mathematics and computer science	OR-1. Be able to: develop and analyze new mathematical models for solving applied problems	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
OPK-4 Able to combine and adapt existing information and communication technologies to solve problems in the field of professional	IOPK-4.1 Analyzes problems of applied mathematics and computer science using information technology	OR-1. Proficient in: analyzing problems of applied mathematics and computer science using information technology	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession

activity, taking into account information security requirements	IOPK-4.2 Takes into account the basic information security requirements	OR-1. Be able to: take into account basic information security requirements	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IOPK-4.3 Uses modern information and communication technologies to solve problems in the field of applied mathematics and computer science, taking into account information security requirements	OR-1. Possess: modern information and communication technologies for solving problems in the field of applied mathematics and computer science, taking into account information security requirements	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession
PC-1. Able to develop and apply mathematical methods, algorithms, software to solve problems in research and design activities.	IPC -1.1 Analyzes the tasks of research and design activities in order to select mathematical and algorithmic tools.	OR-1. Be able to: analyze the tasks of research and design activities in order to select mathematical and algorithmic tools.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Possess: skills in using mathematical methods, algorithms, software to solve problems in research and design activities.	Lack of ownership	Generally successful but not systematically pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession

	IPC -1.2 Develops new methods, models, algorithms and software for solving problems in the field of professional activity.	OR-1. Be able to: apply existing mathematical methods, algorithms and software to solve problems in the field of professional activity.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IPK-1.3 Develops new methods, models, algorithms and software for solving problems in the field of professional activity	OR-1. Be able to: develop new methods, models, algorithms and software to solve problems in the field of professional activity	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
PC-2 Capable of carrying out research developments in the study of independent topics, as well as topics determined by the customer, obtaining new scientific and applied results independently and as part of a scientific team.	IPC -2.1 Analyzes research topics in order to clearly define research objectives and study the subject area.	OR-1. Be able to: conduct a primary analysis of theoretical sources and achieved results on a similar problem.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Be able to: compile a bibliography on the research topic.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-3. Be able to: analyze research topics in order to clearly define research objectives and study the subject area.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill

	IPC -2.2 Decomposes the research development process into stages and is able to clearly define the goals and objectives of each stage.	OR-1. Know: Stages of the R&D process.	Lack of knowledge	Generally successful but not systematically implemented knowledge	Generally successful knowledge, but accompanied by some errors	Formed knowledge
		OR-2. Be able to: determine the goals and objectives of each stage.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IPC -2.3 Able to obtain new scientific and applied results independently and as part of a scientific team.	OR-1. Be able to: formulate new scientific and applied results independently and as part of a scientific team.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
PC-3 Able to present the results of scientific research, draw up technical documentation at various stages of project development.	IPK -3.1 Can clearly and clearly describe the scientific results obtained, providing evidence, arguments, and examples of implementation.	OR-1. Be able to: accurately describe the scientific results obtained, providing evidence, arguments, and examples of implementation.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
		OR-2. Be able to: describe the methodology and technology of design.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
	IPK -3.2 Able to prepare technical documentation, reports on research and development, in	OR-1. Be able to: write a report on the internship.	Lack of skill	Generally successful but not systematically practiced skill	A generally successful skill, but accompanied by some errors	Formed skill

	accordance with current standards for the preparation of technical documentation.	OR-2. Possess: skills in developing documents and planning work to create a project.	Lack of ownership	Generally successful but not systematical ly pursued possession	Generally successful, but accompanied by some errors, ownership	Formed possession	
PC-4 Able to identify a problem situation, set problems for data analysis in social sciences, select mathematical and hardware tools to solve them	IPC -3.3 Capable of writing articles, reviews, incl. in English	OR-1. Be able to: analyze sources and achieved results on a similar problem.	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill	
		OR-2. Be able to: prepare articles, do literature reviews, incl. in English.	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill	
	IPK-4.1 Provides an assessment of the behavior of society or its individual groups based on data analysis	OR-1. Be able to: assess the behavior of society or its individual groups based on data analysis	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill	
		IPK-4.2 Collects information from the Internet, incl. from social networks, and processes it	OR-1. Be able to: collect and process information from the Internet	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
			OR-1. Be able to: analyze the information received and find hidden patterns	Lack of skill	Generally successful but not systematical ly practiced skill	A generally successful skill, but accompanied by some errors	Formed skill
PC-5 Able to select methods, draw up	IPK-5.1 Uses modern information	OR-1. Own: modern information processing technologies when solving problems of industrial data	Lack of ownership	Generally successful but not	Generally successful, but	Formed possession	

<p>technical specifications and develop algorithms for solving problems of industrial data analysis</p> <p>PC-6 Capable of managing the receipt, storage, transmission, and processing of big data</p>	<p>processing technologies and computer technology when solving problems of industrial data analysis</p>	<p>analysis</p>		<p>systematically pursued possession</p>	<p>accompanied by some errors, ownership</p>	
	<p>IPK-5.2 Able to collect industrial data, knows the specifics of such data</p>	<p>OR-1. Be able to: collect industrial data</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>
		<p>OR-2. Know: the specifics of industrial data</p>	<p>Lack of knowledge</p>	<p>Generally successful but not systematically implemented knowledge</p>	<p>Generally successful knowledge, but accompanied by some errors</p>	<p>Formed knowledge</p>
	<p>IPC-5.3 Draws up technical specifications for a task in a professional area</p>	<p>OR-1. Be able to: draw up technical specifications for a task in a professional area</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>
		<p>IPK-6.1 Monitors and evaluates big data processing performance</p>	<p>OR-1. Be able to: monitor and evaluate big data processing performance</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>
	<p>IPK-6.2 Uses methods and tools for receiving, storing, transmitting, and processing big data</p>	<p>OR-1. Proficient in: methods and tools for receiving, storing, transmitting, processing big data</p>	<p>Lack of ownership</p>	<p>Generally successful but not systematically pursued possession</p>	<p>Generally successful, but accompanied by some errors, ownership</p>	<p>Formed possession</p>
	<p>IPK-6.3 Develops proposals to improve the performance of big data processing</p>	<p>OR-1. Be able to: develop proposals for improving the performance of big data processing</p>	<p>Lack of skill</p>	<p>Generally successful but not systematically practiced skill</p>	<p>A generally successful skill, but accompanied by some errors</p>	<p>Formed skill</p>

2. Stages of competency formation and types of evaluation tools

№	Stages of competency formation (discipline sections)	Code and name of training outcomes	Type of evaluation tool (tests, assignments, cases, questions, etc.)
1	Working with scientific literature on the research topic	OR-1.1.1, OR-1.2.1, OR-1.3.1, OR-2.1.1, OR-2.2.1, OR-2.3.1	Questions, discussion
2	Statement of a scientific problem	OR-1.1.2, OR-1.2.2, OR-1.3.2, OR-2.1.1	Questions, discussion
3	Development of methods for studying a scientific problem	OR-2.1.1, OR-2.2.1, OR-2.3.1	Questions, discussion
4	Analytical solution of the problem	OR-2.1.1, OR-1.1.2, OR-1.2.2, OR-1.3.2	Questions, discussion
5	Conducting statistical (numerical) experiments	OR-1.1.1, OR-1.2.1, OR-1.3.1	Questions, discussion
6	Registration of research results in the form of a report	OR-1.1.1, OR-1.2.1, OR-1.3.1	Questions, discussion
7	Public protection of research results	OR-6.1.1, OR-6.2.1, OR-6.3.1	Questions, discussion

3. Typical control tasks or other materials necessary for the assessment of educational training outcomes

3.1. Typical tasks for conducting ongoing monitoring of progress in the discipline

Current monitoring of progress is carried out by the head of the research work based on the results of discussion with the student of the stages of the research work.

3.2. Typical tasks for conducting intermediate certification in the discipline.

Interim certification is carried out in the form of a test with assessment by students publicly defending individual reports on their internship before the commission.

4. Methodological materials that determine the procedures for evaluating training outcomes

4.1. Methodological materials for assessing the current control of progress in the discipline.

Current monitoring of progress is carried out by the head of the research work based on the results of the contact work between the student and the scientific supervisor and based on the results of a discussion with the student about the stages of the research work.

4.2. Methodological materials for conducting intermediate certification in the discipline.

The results of the internship are determined by grades “excellent”, “good”, “satisfactory”, “unsatisfactory” in accordance with the table below.

unsatisfactory	satisfactory	good	excellent
The student did not provide an individual report on the internship	The student provided a report. At the public defense he showed poor knowledge in the subject area	The student provided a report. At the public defense he showed good knowledge in the subject area	The student provided a report. At the public defense he showed deep knowledge in the subject area