

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

Institute of Applied Mathematics and Computer Science



Evaluation materials of the current control and intermediate certification of the
Master Thesis with Defense

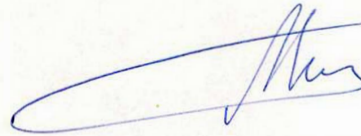
in the major of training
01.04.02 Applied mathematics and informatics

Orientation (profile) of training:
Big Data and Data Science

Tomsk – 2025

ET were implemented:

Dr. Tech. sciences, professor,
Head of the Department of Theoretical
fundamentals of computer science



A.V. Zamyatin

Ph.D. physics and mathematics Sciences, Associate Professor
Associate Professor of the Department
of Information Security



N.A. Vihor

Ph.D. physics and mathematics Sciences, Associate Professor,
Associate Professor of the Department
of Applied Mathematics



E.Yu. Danilyuk

Reviewer:

Dr. tech. sciences, professor,
Head of the Department of Applied Informatics



S.P. Sushchenko

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 22.05.2025 № 1

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

The Master Thesis with Defense (MTD) checks the level of development of competencies and the degree of mastery of the graduate's theoretical knowledge, skills and practical skills for professional activities as a result of mastering the educational program. Competencies for defending a final qualifying thesis are presented in the table.

Competencies	Criteria for evaluating training outcomes			
	Excellent	Good	Satisfactory	Unsatisfactory
UK-1. Able to critically analyze problem situations based on a systematic approach and develop an action strategy	Demonstration of a high level of competence development. Formed knowledge, skill, possession	Overall, successful development of competence. Generally successful, but accompanied by individual errors, knowledge, skill, possession	Partial, fragmented development of competence. Generally successful, but not systematically implemented knowledge, skill, possession	Demonstrates a low level of competence development. Lack of knowledge skills, possessions
UK-2. Able to manage a project at all stages of its life cycle				
UK-3. Able to organize and manage the work of a team, developing a team strategy to achieve the goal				
UK-4. Able to use modern communication technologies, including in foreign language(s), for academic and professional interaction				
UK-5. Able to analyze and take into account the diversity of cultures in the process of intercultural interaction				
UK-6. Able to determine and implement priorities of own activities and ways to improve them based on self-assessment				
OPK-1. Capable of solving current problems of fundamental and applied mathematics.				

OPK-2. Able to improve and implement new mathematical methods for solving applied problems.				
OPK-3. Able to develop mathematical models and analyze them when solving problems in the field of professional activity.				
OPK-4. Able to combine and adapt existing information and communication technologies to solve problems in the field of professional activity, taking into account information security requirements.				
PC-1. Able to develop and apply mathematical methods, algorithms, software to solve problems in research and design activities.				
PC-2. Able to carry out research developments in the study of independent topics, as well as topics determined by the customer, to obtain new scientific and applied results independently and as part of a scientific team.				
PC-3. Able to present the results of scientific research, draw up technical documentation at various stages of project development.				
PC-4. Able to identify a problem situation, set problems for data analysis in the social sciences, and select mathematical and hardware tools to solve them.				
PC-5. Able to select methods, draw up technical specifications and develop algorithms for solving problems of industrial data analysis.				
PC-6. Able to manage the receipt, storage, transmission, and processing of big data.				

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

List of questions for the defense of the thesis:

1. How many processors are used for parallel computing?
2. Is it possible to estimate the share of calculations that are carried out by the central processor and the video card processor?
3. What software systems with similar functionality do you know?
4. Name the characteristics in which your system is superior to existing analogues.
5. In what subject areas, other than those you have studied, can your system be applied?
6. How does a portal differ from a Web site?
7. Explain the reasons for choosing a particular technology to implement your project.
8. What are the communication line requirements for your application?
9. How do you understand whether your database scheme is optimal or not?
10. How is non-intersection of multiple keys ensured when migrating data to a DBMS?
11. How much code have you written?
12. Can the structure of your site change?
13. What algorithms do you use in your work?
14. What is the main value of this work?
15. How was the subject area studied?
16. Why is the product made as a separate program and not a plug-in for Photoshop?
17. Under what parameters is the robot considered operational?
18. Which of the disadvantages of analogues have you eliminated?
19. What Web services does your application work with?
20. What makes it easy to move from the data model to classes?
21. Is it possible to control the movement of a virtual object?
22. What DBMS is used in your project?
23. Compare the capabilities of Chen's model and the ontological one.
24. What formula do you use to calculate a hash function?
25. Explain the difference between object-based and structured design approaches.
26. What is a standard design solution?
27. Basic concepts of the Unified Modeling Language.
28. Main types of UML diagrams.
29. Review of CASE tools for constructing UML diagrams.
30. Formats for describing design patterns.
31. Generating standard design solutions.
32. Structural design solutions.
33. Behavioral design decisions.
34. General purpose architectural patterns.
35. Typical techniques for organizing business logic.
36. Client/server applications, basic architectural solutions.
37. Architectural solutions for distributed data processing.
38. What is an information security policy?
39. Explain the purpose of the following cryptographic protocols: exchange of confidential messages, formation of an electronic digital signature, key distribution.
40. List the levels of information security.

42. What is the administrative level of information security?

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

The thesis is carried out in the form of a master's final qualifying thesis under the guidance of the supervisor of the thesis.

The organization of preparation for the thesis defense procedure involves the head of the educational program, the academic supervisor of the thesis, a consultant (if necessary), students and employees of the dean's office of the Institute of Applied Mathematics and Computer Science.

When solving complex complex problems, teams of students of no more than 3 people are created to perform high-tech experiments, in which each student performs his or her specific task in accordance with the general task.

Graduate qualifying works are supervised by scientific and pedagogical workers:

- having an academic title or an academic degree of Doctor of Science – without restrictions;

- those who have an academic degree of Candidate of Sciences, but without an academic title - only bachelor's and specialist's thesis, as well as master's theses by decision of the academic council of the Institute of Applied Mathematics and Computer Science.

The student selects the topic of the thesis from an indicative list of topics (Appendix A), guided by interest in the problem, the possibility of obtaining factual data, the availability of specialized literature, taking into account that the main requirement is the scientific and practical relevance and novelty of the topic. The student can work on an independently proposed topic, provided that the feasibility of its development is justified for practical application in the field of professional activity or on a specific object of professional activity in the direction of training 01.04.02 Applied Mathematics and Computer Science (master's level) and the profile "Intellectual Analysis of Big Data".

The student writes an application addressed to the director of the Institute of Applied Mathematics and Computer Science, in which he formulates the topic of his thesis. The application is agreed upon by the scientific supervisor of the Research and Development Committee and the program manager. Based on the students' applications, an order is issued to assign topics and scientific supervisors of the thesis to the students.

Before starting the final qualifying work, the student receives from the academic supervisor of the thesis a task to complete the thesis, specifying the volume and content of the thesis (Appendix B).

The student independently performs high-tech research in accordance with the requirements of this Program during the period of research work, internships and state assessment tests.

The student is responsible for the accuracy of the data presented in the thesis; when borrowing individual materials and results, he refers to the authors and sources.

The text of the thesis is checked by the scientific supervisor of the thesis for the amount of borrowing. To check the text of the thesis for the amount of borrowing, the scientific supervisors of the thesis use the publicly available service "Antiplagiat" (<https://www.antiplagiat.ru/>). The share of the author's text in the thesis must be at least 70%.

The preliminary defense of the thesis takes place as part of the defense of the report on pre-graduation practice. Based on the results of the defense, it is possible to adjust the topic by making changes to the previously issued order on assigning topics and scientific supervisors of the thesis to students.

After the student completes the preparation of the thesis, the supervisor of the specified work provides the secretary of the State Examination Committee with a written review of the student's work during the preparation of the thesis (hereinafter referred to as the review). The review template and requirements for its content are presented in Appendix B.

The thesis, no later than 12 calendar days before the defense, is sent to one or more reviewers from among persons who are not employees of NI TSU for review. The reviewer conducts an analysis of the research work and submits a written review of the specified work to the State Examination Committee (hereinafter referred to as the review). If the thesis is interdisciplinary in nature, it is sent to several reviewers.

The Secretary of the State Examination Committee ensures that the student is familiarized with the review and review(s) no later than 5 calendar days before the day of the thesis defense.

The thesis is allowed for defense by the decision of the head of the educational program no later than 3 days before the defense. The thesis may be admitted for defense in the event of negative feedback from the supervisor based on the decision of the head of the educational program, made with the participation of the commission for the defense of reports on pre-graduation practice, the supervisor of the thesis and the author of the work.

The text of the thesis is posted in the electronic library system of NI TSU (repository of the National Library of TSU) in accordance with the Regulations for posting the texts of the essay in the electronic library system of the NI TSU.

The thesis, feedback and review are transferred to the State Examination Committee no later than 2 calendar days before the day of defense of the work. An assignment for the thesis, a report with the results of the originality check (with the signature of the supervisor of the thesis) is sewn into the work. The work includes a certificate from the National Library of TSU about the placement of the text of the research project in the repository and an act on the implementation of the results of the research project (if available).

The student prepares demonstration materials for defense (a presentation prepared using PowerPoint/Impress (ppt/pptx/odp file), or other means (pdf file)) in addition to the report for 10-15 minutes. The number of presentation slides is from 10 to 25, at the rate of 1 to 3 slides for every minute of the report. The recommended presentation structure is as follows:

The 1st slide of the presentation should contain:

- type of work (final qualifying work),
- exact title of the work,
- name of the area of training and profile,
- last name, first name, patronymic of the author,
- position, degree, rank, surname, initials of the scientific supervisor of the Research and Development Committee.

Next are slides describing the relevance, purpose, objectives of the study; slides with the main results of the study.

The last slide of the presentation should contain:

- conclusions,
- publications, implementations (if any).

Slides must be numbered.

4. Criteria for assessing the defense of final qualifying work

Grade	Evaluation criteria
Excellent	An “excellent” grade is given if: the thesis is devoted to a topical and scientifically significant topic; the content of the thesis corresponds to the topic, the design of the essay complies with the requirements; the research is based on an analysis of the situation on this issue, and its author has demonstrated the necessary skills in analyzing sources; the work consists of a theoretical section and a description of practical implementation, which demonstrates the acquired skills in using modern information technologies and methods for building information systems; the work contains a detailed analysis of the problem, goals and objectives are consistently and correctly defined, the work has a clear internal logical structure; during the defense, the author confidently and reasonably answered the questions of the members of the State Examination Committee and the comments of the reviewer (reviewers); The defense process demonstrated the full development of the chosen scientific problem and the competence of the graduate.
Good	A “good” grade is given if: the thesis is devoted to a topical and scientifically significant topic; the content of the thesis corresponds to the topic, the design of the essay complies with the requirements; the work consists of a theoretical section and a description of practical implementation, demonstrating the skills of using modern information technologies and methods of building information systems, but contains a number of shortcomings that are not fundamental; the work contains a detailed analysis of the problem, the goals and objectives are correctly defined, the work has an internal logical structure, but some inaccuracies are allowed; during the defense, the author answered the questions of the members of the State Examination Committee and the comments of the reviewers quite fully and reasonably; The defense process demonstrated the necessary and generally proven elaboration of the chosen scientific problem.
Satisfactory	A “satisfactory” grade is given if: the content of the thesis does not fully correspond to the topic, the design of the essay does not fully meet the requirements; the work contains an analysis of the problem, goals and objectives are defined, but the work has errors in the internal logical structure, inaccuracies are made; during the defense, the author experienced difficulties in answering questions from members of the State Examination Committee and comments from reviewers; The defense process as a whole demonstrated the necessary elaboration of the chosen scientific problem.
Unsatisfactory	An “unsatisfactory” grade is given if: the content of the thesis does not correspond to the topic, the design of the essay does not meet the requirements; gross errors were made in the logic of drawing several of the most significant conclusions; during the defense process, facts of plagiarism of the main results of the work were revealed; answers to questions from members of the State Examination Committee do not reveal the essence of the issue; The defense

	process demonstrated the unfoundedness of statements, achievements and developments that were quite important for this work.
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