

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
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Mathematics and Computer Science
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Work program 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

Form of study

full-time

Year of admission

2023

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1. The purpose and objectives of the state final certification

1.1 The purpose of the state final certification (hereinafter - SFC) is to determine the compliance of the results of mastering by students in the educational program in the field of study 01.04.02 Applied Mathematics and Computer Science (master's level), focus (profile) "Big Data and Data Science" with the requirements of the OS NI TSU for direction of training 01.04.02 Applied mathematics and computer science (master's level).

1.2 The tasks of the State Inspectorate are:

– checking the level of development of competencies and the degree of mastery of the graduate's theoretical knowledge, abilities and practical skills for professional activities in accordance with the OS of NI TSU and the educational program in the field of study 01.04.02 Applied mathematics and computer science (master's level), focus (profile) "Big Data" and Data Science", taking into account the types of activities that the program is focused on;

– making a decision on awarding a "master" qualification (degree) based on the results of the State Examination and issuing a document on higher education;

– development of recommendations for improving the training of graduates based on the results of the work of the state examination commission (SEC).

2. Place of state final certification in the structure of the educational program

2.1 The SFC represents Block 3 "State Final Certification" of the educational program, it fully relates to the basic part, is mandatory and ends with the assignment of a "master" qualification (degree).

3. Scope, forms and period of state final certification

3.1 The volume of the SFC is 9 credit units, 324 hours. 5 5/6 weeks are allocated for the state final certification.

3.2 The SFC is carried out in the form of defending a master's final qualifying work (hereinafter referred to as the FQR). In accordance with the OS of NI TSU, the defense of final qualifying work includes the implementation and defense of final qualifying work.

3.3 The State Examination is carried out within the time limits established by the calendar curriculum of the educational program. The schedule of certification tests is brought to the attention of students no later than 1 month before the start of the state examination period.

4. The procedure for organizing and conducting state final certification

4.1 A student who does not have academic debt and has fully completed the curriculum or individual curriculum for the educational program in the field of preparation 01.04.02 Applied Mathematics and Computer Science (master's level), focus (profile) "Big Data and Data Science" is allowed to take the State Examination. "

4.2 To conduct the State Examination, state examination commissions are created at NI TSU.

4.3 To consider appeals based on the results of the State Examination, appeal commissions are created at NR TSU.

4.4 The state examination and appeal commissions (hereinafter collectively referred to as the commissions) operate during the calendar year.

4.5 The main functions of the GEC are:

- determination of compliance of the results of mastering by students in the educational program in the field of study 01.04.02 Applied Mathematics and Computer Science (master's level), focus (profile) "Big Data and Data Science" with the requirements of the OS of NI TSU by checking the level of competencies and the degree of the graduate's knowledge of theoretical knowledge, skills and practical skills for professional activities, taking into account the types of activities that the educational program is focused on;

- making a decision on awarding a master's qualification (degree) based on the results of the State Examination and issuing a document on education (with honors/without honors) and qualifications to the student;

- development of recommendations aimed at improving the training of students, based on the results of the work of the State Examination Committee.

4.6 The main function of the appeal commission is to consider appeals from students about violations, in their opinion, of the established procedure for conducting the state certification test.

4.7 The main form of activity of the commissions during the state certification test is meetings.

4.8 The result of the state certification test is determined by the grades "excellent", "good", "satisfactory", "unsatisfactory". Grades "excellent", "good", "satisfactory" mean successful completion of the state certification test.

4.9 Students who did not pass the State Examination Test due to failure to appear for the state certification test for a valid reason (temporary disability, performance of public or government duties, summons to court, transport problems (flight cancellation, lack of tickets), weather conditions or in other cases, a list of which is established by the organization independently), has the right to pass it within 6 months after completion of the State Examination. The student must submit to NI TSU a document confirming the reason for his absence.

4.10 Students who do not pass the State Examination Test due to failure to appear for the state certification test for an unexcused reason or due to receiving an "unsatisfactory" grade are expelled from NI TSU with the issuance of a certificate of training as having failed to fulfill their obligations to conscientiously master the educational program and implement the curriculum.

4.11 A person who has not passed the State Examination can re-pass the State Examination no earlier than 10 months and no later than 5 years after the date of the state final certification, which the student did not pass. The specified person can re-pass the State Examination no more than two times. To re-pass the State Examination, the specified person, upon his application, is reinstated at NR TSU for a period of time established by the organization, but not less than the period of time provided for by the calendar academic schedule for the State Examination Examination for the relevant educational program. When re-passing the State Examination, at the request of the student, by decision of the organization, he may be assigned a different topic for his final qualifying work.

4.12 SFC for students with disabilities and persons with limited health capabilities (hereinafter referred to as HIA) can be carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status. The specifics of conducting a State Examination for disabled people and persons with disabilities are determined by clause 9 of this program.

4.13 SFC can be carried out using distance learning technologies (hereinafter referred to as DET). The specifics of conducting a state inspection using DOT are determined by clause 10 of this program.

4.14 Based on the results of the state certification test, the student has the right to appeal. The procedure for appealing the results of the state certification test is determined by clause 11 of this program.

5. Results of mastering the educational program

5.1 The State Academy of Sciences checks the level of development of competencies and the degree of mastery of the graduate's theoretical knowledge, abilities and practical skills for professional activities as a result of mastering the educational program. The distribution of competencies for defending a final qualifying work is presented in Table 1.

Table 1 – Distribution of competencies for defending final qualifying work

Competence	Final qualifying work
Universal competencies	
UK-1. Able to critically analyze problem situations based on a systematic approach and develop an action strategy	+
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	+
General professional competencies	
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.	+
Professional competencies	

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.	+

6. The procedure for completing the final qualifying work and preparing for the defense of the final qualifying work

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

6.2 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.

6.3 When solving complex complex problems, teams of students are created to carry out research and development work of no more than 3 people, in which each student performs his specific task in accordance with the general task.

6.4 Graduate qualification 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.

6.5 The student selects the topic of the thesis from the approximate 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".

6.6 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.

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

6.8 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.

6.9 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.

6.10 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%.

6.11 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.

6.12 After the student completes the preparation of the thesis, the scientific 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.

6.13 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 NR 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.

6.14 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 defense of the thesis.

6.15 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.

6.16 The text of the thesis is posted in the electronic library system of NR 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 NR TSU.

6.17 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).

6.18 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.

7. Requirements for completing final qualifying work

7.1 In its structure, the FQW should consist of sequentially located main elements:

- title page;
- task to complete the research and development work;
- annotation;
- table of contents;
- list of symbols, abbreviations (if necessary);
- introduction;
- the main part of the text;
- conclusion;
- literature;
- applications (if necessary).

7.2 The title page is the first page of the work and is formatted according to the sample (Appendix D).

7.3 The task for completing the research and development work is sewn into the work and is not numbered.

7.4 The abstract contains a brief description of the research results, 1-2 pages in length.

7.5 The table of contents includes a listing of the parts of the work, starting with the introduction, titles of chapters and paragraphs and ending with appendices indicating pages.

7.6 The introduction describes the relevance of the topic and the degree of its development, the purpose, objectives, object and subject of the study, the methods used and the practical significance of the study.

7.7 The main part of the work includes chapters, structured into paragraphs, and corresponds to the tasks set in the introduction.

7.8 The conclusion contains the main, most significant conclusions and results formulated by the author based on the research conducted, and recommendations for the application of the results obtained.

7.9 The list of references contains a list of bibliographic sources used in writing the work.

7.10 Applications of the work may include statistical data and tables, graphic material, calculations and other auxiliary materials.

7.11 The recommended amount of work is 70-100 pages, application pages are not taken into account in the total amount of work.

7.12 When writing a work, the author is obliged to provide bibliographical references to the sources from which he borrows material or individual results.

7.13 The FQW must be executed in accordance with the requirements of Appendix D.

8. Criteria for assessing the defense of final qualifying work

8.1 The decision of the State Examination Committee on the final assessment is based on:

- feedback from the scientific supervisor of the research and development work;
- assessment by members of the State Examination Committee of the content of the work and its defense (including the report, answers to questions and comments).

8.2 The results of the defense of the thesis are determined by the grades “excellent”, “good”, “satisfactory”, “unsatisfactory”, announced to the student after the end of the State Examination on the day of defense and entered into the grade book and statement.

8.3 “Excellent” grade is given if:

- The FQW is dedicated 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 convincingly 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.

8.4 A “good” grade is given if:

- The FQW is dedicated 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 for 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.

8.5 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 comply with 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 selected scientific problem.

8.6 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.

9. Features of the state final certification for students with disabilities and persons with disabilities

9.1 The Deputy Director for Academic Affairs, no later than 6 months before the SFC, brings to the attention of students with disabilities and persons with special needs in a form accessible to them the local regulations of NR TSU on the issues of conducting the SFC.

9.2 A disabled student or a person with disabilities, if necessary, no later than 3 months before the start of the state final certification, submits a written application to the dean's office about the need to create special conditions for him during state certification tests, indicating his individual characteristics. Documents confirming the student's individual characteristics are attached to the application. In the application, the student indicates for each state certification test the need (lack of need):

- presence of an assistant at the state certification test;
- increasing the duration of passing the state certification test in relation to the established duration.

9.3 In the case of conducting a state examination using DOT and if it is necessary to have an assistant or fulfill other special conditions, a disabled student or a person with disabilities submits an additional application to that specified in clause 9.2 addressed to the Deputy Director for Academic Affairs no later than 7 calendar days before the date of the conduct certification test. The application is submitted in any written form from the student's electronic mailbox to the email of the dean's office of the Institute of Applied Mathematics and Computer Science (e-mail: csi@mail.tsu.ru).

10. Features of conducting state final certification using distance educational technologies

10.1 Conducting the State Examination with the use of DOT is carried out in cases provided for by the Regulations on the State Examination at NR TSU at the request of the student addressed to the director of the Institute of Applied Mathematics and Computer Science (Appendix E).

10.2 SFC using DOT is carried out via video conference. The organization of video conferencing for State Examination meetings and its technical support is carried out by the Deputy Director for e-learning and with information support from the Institute of Education and Education of TSU.

10.3 Requirements for information technology (software and hardware) for conducting state inspection using DOT are listed in sections of clause 12 of this program.

10.4 The student, no later than 2 calendar days before the defense of the thesis, submits the text of the thesis, review, review to the dean's office of the Institute of Applied Mathematics and Computer Science by e-mail (e-mail: csi@mail.tsu.ru). The dean's office responds by sending a notification of receipt.

10.5 The Deputy Director for e-learning together with the Secretary of the State Examination Committee, no later than one day before the certification tests, check the technical readiness of students and members of the State Examination Committee using a test communication session in a virtual audience/video conference created for the State Examination procedure.

10.6 The Deputy Director for e-learning, 30 minutes before the start of the certification test via video conference, checks the connection of the chairman, members and secretary of the State Examination Committee and the operation of the equipment in accordance with the

requirements of the Regulations on State Examination at NR TSU. The Chairman of the State Electoral Commission instructs the members of the State Electoral Committee.

10.7 Students no later than 10 minutes before the start of the meeting of the State Executive Committee in videoconference mode connect to the assigned virtual audience/videoconference session and do not disconnect until the end of their speech and answers to the questions of the State Executive Committee. Scientific supervisors of the thesis and other interested parties are connected to the designated virtual audience/videoconference session for the defense of the thesis if desired.

10.8 Before the start of the meeting, the Chairman of the State Electoral Committee introduces himself, announces the number of members present, checks the presence of a quorum and introduces by name and patronymic each member of the State Electoral Committee, the secretary of the State Electoral Committee and other participants (if any), indicating their position.

10.9 The Secretary of the State Examination Committee brings to students information on the procedure for conducting the State Examination in remote form, including the procedure for discussing and agreeing on the results of the certification test and announcing the results, the procedure for conducting an appeal, announces the sequence of calls for students to speak in accordance with the drawn up schedule, taking into account their presence (this information is duplicated in text form in a video conference system).

10.10 The Secretary of the State Examination Committee carries out identification of the student's identity before the student begins to pass the certification test, which consists of visually verifying the data and photo of the identity document with the person presenting this document. If it is impossible to identify the individual, the student is suspended from taking the State Examination, and a "failure to appear" entry is made in the State Examination Form.

10.11 A student, if necessary, can receive technical assistance from the Deputy Director for e-learning by contacting him promptly with a description of the problem using the contacts provided in advance. If it is impossible for the Deputy Director for e-learning to provide assistance, the student contacts the Institute of Distance Education of NR TSU by corporate mail or by telephone.

10.12 The Chairman of the State Examination Committee, in the event of technical failures in the operation of the equipment and/or communication channel during the preparation and/or performance of the student and the latter's failure to communicate again for more than 10 minutes, has the right to reschedule the certification test (with the replacement of the examination card in the case of a state exam) to another time within this day or on another day, but within the established period of operation of the State Electrical Station. The Secretary of the State Examination Committee draws up an appropriate protocol, which describes the nature of the technical failure, the time of occurrence of the technical failure and the time of its elimination, and also indicates the new date and time of the rescheduled certification test.

10.13 If a student fails to communicate for more than 10 minutes from the start of the certification test, he is considered to have failed to appear for the certification test, and a "failure to show" entry is made in the State Examination Sheet.

10.19 After the completion of the students' presentations, the members of the State Examination Committee begin to discuss the results of the certification tests; the students are transferred to a separate webinar room for the duration of the discussion. The secretary of the State Examination Committee records in the protocol the questions of the members of the State Examination Committee to the student, the recommendations of the members of the State Examination Committee, the decision of the State Examination Committee, and the grade given for the State Examination procedure. The minutes also record the specifics of holding the meeting of the State Examination Committee - via videoconference using DOT.

10.20 After the discussion is completed and the results are recorded in the minutes, students return to videoconference mode to hear the results of the defense of their final qualifying work. The assessment is brought to the attention of the student on the day of the

certification test and is included in the minutes of the meeting, in the examination sheet and in the grade book. The absence of a student at the assessment announcement is not a violation of the certification test procedure.

11. Appeal based on the results of the state final certification

11.1 Based on the results of defending the final qualifying work, the student has the right to file an appeal with the appeal commission about a violation, in his opinion, of the established procedure for conducting the state certification test.

11.2 The appeal is submitted in writing by the student personally to the appeal commission no later than the next working day after the announcement of the results of the defense of the final qualifying work. The appeal is filed in the name of the chairman of the appeal commission and transferred to the director of the Institute of Applied Mathematics and Computer Science.

11.3 When conducting a state examination using DOT, the student submits an appeal to the appeal commission electronically. The application is sent to the email of the dean's office of the Institute of Applied Mathematics and Computer Science (e-mail: csi@mail.tsu.ru) indicating the subject "SFC Appeal".

11.4 To consider the appeal, the secretary of the State Examination Committee sends to the appeal commission the minutes of the meeting of the State Examination Committee, the conclusion of the chairman of the State Examination Committee on compliance with procedural issues during the state certification test, as well as the written answers of the student (if any), the examination papers, feedback, review.

11.5 When conducting a state inspection using DOT, the secretary of the State Examination Committee sends the materials listed in clause 11.4 to the appeal commission in electronic form. Audio and video recordings of the State Examination procedure, stored on the servers of the Institute of Distance Education of NR TSU, can also be used when considering the appeal.

11.6 The appeal is considered no more than 2 working days from the date of its filing at a meeting of the appeal commission, to which the chairman of the State Examination Committee and the student who filed the appeal are invited. A meeting of the appeal commission may be held in the absence of the student who filed the appeal, if he fails to appear at the meeting of the appeal commission.

11.7 When conducting a state inspection using DOT, the meeting of the appeal commission is held using DOT via video conference. The student who filed an appeal by email is sent an email notification of the date and time of the appeal committee meeting with a link to the video conference. The meeting of the appeal commission is held in the absence of the student who filed the appeal, if he is not connected to the video conference within 10 minutes from the time specified in the notification.

11.8 When considering an appeal about a violation of the procedure for conducting a state certification test, the appeal commission makes one of the following decisions:

- on the rejection of the appeal, if the information contained in it about violations of the procedure for conducting the state certification test of the student was not confirmed and/or did not affect the result of the state certification test;
- on the satisfaction of the appeal, if the information contained in it about violations of the procedure for conducting the state certification test of the student was confirmed and influenced the result of the state certification test.

If the appeal is granted, the result of the state certification test is subject to cancellation, and therefore the protocol on the consideration of the appeal no later than the next working day is transferred to the State Examination Committee to implement the decision of the appeal commission. The student is given the opportunity to pass the state certification test within the time frame established by the director of the Institute of Applied Mathematics and Computer Science on the recommendation of the chairman of the State Examination Committee.

11.9 The decision of the appeal commission, documented in minutes and signed by its chairman, is brought to the attention of the student who filed the appeal within 3 working days from the date of the meeting of the appeal commission. The fact that the student who filed the appeal has become familiar with the decision of the appeal commission is certified by the student's signature in the protocol. The minutes of the meetings of the appeal commission are sewn into the book of minutes of the meetings of the State Examination Committee.

11.10 When conducting a state examination using DOT, the decision of the appeal commission is documented in a protocol and brought to the attention of the student in person (via video conference with mandatory duplication by email and/or personal account in the EIOS) within the established time frame.

11.11 The decision of the appeal committee is final and cannot be revised.

11.12 The re-conduct of the state certification test of the student who filed the appeal is carried out in the presence of the chairman or one of the members of the appeal commission no later than the date of completion of training in the educational program in accordance with the calendar academic schedule.

11.13 An appeal against re-conducting the state certification test will not be accepted.

12. Information technologies used during state final certification

12.1 Hardware:

- personal computer with an Internet connection with an access speed of at least 2 Mbit/s;
- webcam, microphone and audio speakers or headphones.

12.2 Software:

- a suite of office applications Microsoft Office Standard 2013 Russian (or its equivalent with comparable functionality), including the Word word processor, Excel spreadsheet processor, and a program for preparing and viewing PowerPoint presentations;
- web browser Mozilla Firefox or Google Chrome (or their analogues);
- Adobe Connect Pro video conferencing system (or its analogues with comparable functionality), supporting audio and video recording of a communication session.

12.3 Information and reference systems:

- Electronic catalog of the TSU Scientific Library – <http://chamo.lib.tsu.ru/search/>;
- Electronic library (repository) of TSU – <http://vital.lib.tsu.ru/>;
- EBS Lan – <http://e.lanbook.com/>;
- EBS Student Consultant – <http://www.studentlibrary.ru/>;
- EBS Yurayt – <http://www.biblio-online.ru/>;
- EBS ZNANIUM.COM – <https://new.znanium.com/>.

12. Material and technical base necessary for conducting state final certification

13.1 Audiences for conducting lectures and seminars, group consultations, ongoing monitoring and intermediate and final certification. Room for group and individual consultations. Rooms for independent work, equipped with computer equipment and access to the Internet, electronic information and educational environment and electronic library systems.

APPENDIX A
Approximate list of master's thesis topics

1. Data mining in marketing research.
2. System for rapid identification of significant changes in landscape cover based on the archive of Earth remote sensing data.
3. Algorithmic and Web service software for forecasting the demand for used cars.
4. Mathematical and software for early medical diagnosis of diseases using computer vision and machine learning methods.
5. Mathematical and software systems for supporting scientific research of bronchial asthma.
6. Linear classification of immunosignature data.
7. Use of machine learning and computer vision technologies for processing biomedical data.
8. Mathematical and software for complex intellectual processing of static and video data in problems of early medical diagnostics.
9. Software service for identifying the reliability level of a process parameter.
10. Information technologies for assessing the quality of life of students in Tomsk.
11. Visual analytics in social and psychological research.
12. Pre-processing of immunosignature analysis data for intelligent analysis tasks.
13. Identification of hidden patterns in the clinical data of patients with endocrinopathies.
14. Information technology for analyzing data from electroneuromyographic studies.
15. Solving the optimization problem using swarm intelligence algorithms.
16. Software for analyzing the digital trace of a person's psychological characteristics.
17. Classification of texts with a high level of distortion for problems of product categorization.
18. Modeling and forecasting the personnel needs of the Russian healthcare system for individual employee positions.
19. Research of methods of analysis and forecasting of one-dimensional time series.
20. Analyze the sentiment of financial news to improve the quality of forecasting changes in stock prices.
21. Use of deep learning tools in localization tasks of lung lobes.
22. Development of a prototype module for detecting anomalies in process signals.
23. Formation of a knowledge base for a medical decision support system.
24. Software for analyzing the educational potential of a student.
25. Creation of a universal algorithm for solving the problem of detecting anomalies in a step type signal.
26. Development of an approach to detecting anomalies in technological signals using artificial neural networks of the LSTM type.

ПРИЛОЖЕНИЕ Б

Шаблон задания на ВКР

Министерство науки и высшего образования Российской Федерации.
НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ (НИ ТГУ)
Институт прикладной математики и компьютерных наук

УТВЕРЖДАЮ
Руководитель ОПОП
д-р. техн. наук, доцент
_____ А.В. Замятин
« _____ » _____ 20__ г.

ЗАДАНИЕ

по выполнению выпускной квалификационной работы магистра обучающемуся

_____ (Ф.И.О. обучающегося)

по направлению подготовки 01.04.02 Прикладная математика и информатика,
направленность (профиль) «Интеллектуальный анализ больших данных»

1 Тема выпускной квалификационной работы магистра

2 Срок сдачи обучающимся выполненной выпускной квалификационной работы:

а) в учебный офис / деканат – _____ б) в ГЭК – _____

3 Исходные данные к работе:

Объект исследования – _____

Предмет исследования – _____

Цель исследования – _____

Задачи:

Методы исследования

Организация или отрасль, по тематике которой выполняется работа, –

4. Краткое содержание работы

Научный руководитель выпускной
квалификационной работы

_____ / _____
(должность, место работы)

(подпись)

_____ / _____
(И.О. Фамилия)

Задание принял к исполнению

_____ / _____
(должность, место работы)

(подпись)

_____ / _____
(И.О. Фамилия)

ПРИЛОЖЕНИЕ В

Шаблон отзыва руководителя ВКР

ОТЗЫВ

на выпускную квалификационную работу магистра по теме «Тема ВКР» обучающегося группы № _____ института прикладной математики и компьютерных наук НИ ТГУ направления подготовки 01.04.02 Прикладная математика и информатика (уровень магистратуры), направленность (профиль) «Интеллектуальный анализ больших данных» Ф.И.О. обучающегося в родительском падеже

Текст отзыва, в котором отражаются:

- актуальность ВКР;
- степень достижения целей ВКР;
- достоинства и недостатки ВКР;
- наличие и значимость практических предложений и рекомендаций, сформулированных в ВКР;
- научная новизна полученных результатов;
- правильность оформления ВКР, включая оценку структуры, стиля, языка изложения, а также использования табличных и графических средств представления информации, в соответствии с правилами, установленными программой ГИА;
- уровень владения компетенциями, продемонстрированный автором работы;
- оценка работы руководителем и рекомендация ВКР к защите;
- заключение о возможности присвоения обучающемуся квалификации «магистр» по направлению подготовки 01.04.02 Прикладная математика и информатика.

Т.о. в отзыве отражается актуальность ВКР; степень достижения целей ВКР; наличие и значимость практических предложений и рекомендаций, сформулированных в ВКР; правильность оформления ВКР, включая оценку структуры, стиля, языка изложения, а также использования табличных и графических средств представления информации, в соответствии с правилами; степень владения автором работы профессиональными знаниями, умениями и навыками; недостатки ВКР; рекомендация ВКР к защите; оценка работы научным руководителем.

Считаю, что магистерская диссертация «Тема ВКР» полностью соответствует требованиям, предъявляемым к выпускным квалификационным работам по направлению подготовки 01.04.02 Прикладная математика и информатика (уровень магистратуры), заслуживает оценки «оценка», а Фамилия Имя Отчество заслуживает присвоения квалификации (степени) магистра.

Научный руководитель ВКР
должность, ученая степень

(подпись) И.О. Фамилия

ПРИЛОЖЕНИЕ Г
Образец титульного листа

Министерство науки и высшего образования Российской Федерации
НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ (ТГУ)
Институт прикладной математики и компьютерных наук

ДОПУСТИТЬ К ЗАЩИТЕ В ГЭК
Руководитель ООП
д-р техн. наук, доцент
_____ А.В. Замятин
« ____ » _____ 202_ г.

ВЫПУСКНАЯ КВАЛИФИКАЦИОННАЯ РАБОТА МАГИСТРА
(МАГИСТЕРСКАЯ ДИССЕРТАЦИЯ)

ТЕМА РАБОТЫ

по направлению подготовки 01.04.02 Прикладная математика и информатика,
направленность (профиль) «Интеллектуальный анализ больших данных»

Фамилия Имя Отчество

Научный руководитель ВКР
доцент, канд. физ.-мат. наук
_____ И.О. Фамилия
« ____ » _____ 202_ г.

Автор работы
студент группы № _____
_____ И.О. Фамилия
« ____ » _____ 202_ г.

ПРИЛОЖЕНИЕ Д

Требования по оформлению выпускной квалификационной работы магистра

1 Общие требования к листу

Работа оформляется на одной стороне стандартного листа белой бумаги формата А4. При наборе текста используется текстовый редактор Microsoft Word или сопоставимые с ним по возможностям.

Размеры полей: левое – 30 мм, правое – 10 мм, верхнее – 20 мм, нижнее – 20 мм.

Текст оформляется шрифтом Times New Roman, размер шрифта – 12 или 14, интервал полуторный, абзацный отступ (красная строка) – 12,5 мм.

Разрешается использовать компьютерные возможности акцентирования внимания на определенных терминах, формулах, теоремах, применяя шрифты разной гарнитуры.

В работе должны быть четкие, не расплывшиеся линии, буквы, цифры и знаки. По всей работе соблюдается равномерная, контрастность и четкость изображения.

2 Названия структурных элементов и их оформление

Наименования структурных элементов работы «АННОТАЦИЯ», «ОГЛАВЛЕНИЕ», «ПЕРЕЧЕНЬ УСЛОВНЫХ ОБОЗНАЧЕНИЙ, СИМВОЛОВ, СОКРАЩЕНИЙ, ТЕРМИНОВ», «ВВЕДЕНИЕ», «ЗАКЛЮЧЕНИЕ», «ЛИТЕРАТУРА», «ПРИЛОЖЕНИЕ» являются заголовками структурных элементов работы.

Заголовки структурных элементов располагаются в середине строки без точки в конце и печатаются прописными (большими) буквами без подчеркивания полужирным шрифтом.

Главы и параграфы должны иметь заголовки.

Заголовки глав и параграфов нумеруются арабскими цифрами и печатаются с абзацного отступа с первой прописной буквы без точки в конце полужирным шрифтом.

Номер параграфа включает номер главы и порядковый номер, разделенные точкой.

После номера главы, параграфа точку не ставят.

Если заголовок состоит из двух предложений, их разделяют точкой. Переносы слов в заголовках не допускаются.

Расстояние между заголовком и текстом должно быть равно двум интервалам (3-4 мм).

Каждый структурный элемент и главы работы начинаются с нового листа. Подразделы (параграфы) оформляются с новой страницы только, если от текста предыдущего подраздела или пункта не осталось на листе места хотя бы для одной строки после наименования этого подраздела (параграфа) или пункта.

3 Нумерация страниц

Все страницы работы нумеруются по порядку арабскими цифрами, соблюдая сквозную нумерацию по всему тексту работы (начинается нумерация с титульного листа и заканчивается списком литературы или приложениями).

Иллюстрации и таблицы, расположенные на отдельных страницах, включаются в общую нумерацию страниц.

Номер страницы проставляется в центре нижней части листа без точки, на титульном листе номер не ставится.

4 Оглавление

В оглавлении перечисляются заголовки структурных элементов работы в порядке их расположения в тексте с указанием номеров страниц.

Номера страниц структурных элементов размещаются по правому краю без применения заполнителя.

Приложения в оглавлении указываются без названий.

5 Иллюстрации

Иллюстрации располагаются в тексте работы непосредственно после текста, в котором они упоминаются впервые, или на следующей странице.

Каждая иллюстрация обозначается подписью, состоящей из слова «Рисунок», её порядкового номера через пробел и названия через тире.

Подпись располагается сразу после иллюстрации посередине строки.

Иллюстрации располагаются так, чтобы их было удобно рассматривать без поворота работы или с поворотом по часовой стрелке.

На все иллюстрации должны быть ссылки в тексте работы.

Иллюстрации, заимствованные из работ других авторов, сопровождаются библиографической ссылкой.

Номера иллюстрация выполняются арабскими цифрами.

Иллюстрации, за исключением иллюстраций приложений, нумеруются сквозной нумерацией.

Для иллюстраций каждого приложения используется отдельная нумерация, выполняемая арабскими цифрами с добавлением перед номером иллюстрации буквы-обозначения приложения.

Иллюстрации могут иметь пояснительные данные (подрисуночный текст), которые располагаются перед подписью к рисунку.

Ссылки на иллюстрации оформляются с использованием слова «рисунок» и указанием её порядкового номера.

6 Таблицы

Таблицы располагаются в тексте работы непосредственно после текста, в котором они упоминаются впервые.

Каждая таблица обозначается наименованием, состоящим из слова «Таблица», её порядкового номера через пробел и названия через тире.

Наименование таблицы помещают над таблицей слева, без абзацного отступа в одну строку.

Таблицы располагаются так, чтобы их было удобно рассматривать без поворота работы или с поворотом по часовой стрелке.

На все таблицы должны быть ссылки в тексте работы.

Таблицы, заимствованные из работ других авторов, сопровождаются библиографической ссылкой.

Номера таблиц выполняются арабскими цифрами.

Таблицы, за исключением таблиц приложений, нумеруются сквозной нумерацией.

Для таблиц каждого приложения используется отдельная нумерация, выполняемая арабскими цифрами с добавлением перед номером таблицы буквы-обозначения приложения.

Таблицу с большим количеством строк допускается переносить на другой лист (страницу). При переносе части таблицы на другой лист (страницу) слово «Таблица» и её номер указывают один раз слева над первой частью таблицы, над другими частями также слева размещают текст «Продолжение таблицы 1» или «Окончание таблицы 1» с соответствующим номером таблицы.

При переносе таблицы на другой лист (страницу) заголовок помещают только над ее первой частью, нижнюю горизонтальную черту, ограничивающую таблицу, не проводят.

Если повторяющийся в разных строках графы таблицы текст из одного слова, то его после первого печатания допускается заменять кавычками, если из двух и более слов, то при первом повторении его заменяют словами «То же», а далее – кавычками.

Ставить кавычки вместо повторяющихся цифр, знаков, математических символов не допускается. Если цифровые или иные данные в какой-либо строке не приводят, то в ней ставят прочерк.

Заголовки граф и строк таблицы следует печатать с прописной (большой) буквы в единственном числе, а подзаголовки граф – со строчной буквы, если они составляют одно предложение с заголовком, или с прописной буквы, если они имеют самостоятельное значение. В конце заголовков и подзаголовков таблиц точки не ставят.

Допускается применять в таблицах размер шрифта меньший, чем в тексте.

Разделять заголовки и подзаголовки боковика и граф диагональными линиями не допускается.

Заголовки граф, как правило, печатают параллельно строкам таблицы. При необходимости допускается перпендикулярное расположение заголовков граф.

Примечание к таблице помещают в конце таблицы над линией, обозначающей окончание таблицы.

Ссылки на таблицы оформляются с использованием слова «таблица» и указанием её порядкового номера.

7 Формулы

Формулы выносятся из текста в отдельную строку.

Выше и ниже каждой формулы должно быть оставлено не менее одной свободной строки.

Если формула не умещается в одну строку, то оно переносится на новую строку после знака (=) или после знаков плюс (+), минус (-), умножения (\times), деления (:), или других математических знаков, причем знак в начале следующей строки повторяют.

Пояснения значений символов и числовых коэффициентов приводятся непосредственно под формулой в той же последовательности, в которой они даны в формуле. Значение каждого символа и числового коэффициента дается с новой строки. Первая строка объяснения начинается со слова «где» без двоеточия. После формулы ставится запятая.

Нумерация формул выполняется арабскими цифрами в круглых скобках справа от формулы.

Формулы, за исключением формул приложений, нумеруются сквозной нумерацией.

Ссылки в тексте на порядковые номера формул оформляются в круглых скобках.

8 Перечисления (списки, перечни)

Перечисления оформляются в виде списка после обобщающего слова с двоеточием.

Элементы перечисления могут быть обозначены одним из следующих способов:

– обозначаются арабскими цифрами с точкой, если элемент перечисления содержит одно или несколько предложений;

– строчными буквами со скобкой, арабскими цифрами со скобкой или символом дефиса, если элемент перечисления содержит слово, словосочетание или одно предложение, причём в конце каждого элемента перечисления ставится запятая или точка с запятой, после последнего элемента – точка.

Каждый элемент перечисления записывается с абзацного отступа.

9 Библиографические ссылки

Объектами составления библиографической ссылки являются все виды опубликованных и неопубликованных документов на любых носителях (в том числе электронные ресурсы локального или удаленного доступа), а также их составные части или группа документов.

При написании работы допускается использовать подстрочные и затекстовые библиографические ссылки. Способ оформления ссылок должен быть единообразен на протяжении всей работы и согласован с научным руководителем ВКР.

Подстрочные библиографические ссылки оформляются сносками, вынесенными из текста документа в конец страницы (в Microsoft Word меню «Ссылки», команда «Вставить сноску»).

При нумерации подстрочных библиографических ссылок применяют единообразную сквозную нумерацию по всему тексту.

В тексте сноски указываются сведения об источнике, оформленные в соответствии с требованиями библиографического описания документа.

Затекстовые библиографические ссылки оформляются отсылкой, представляющей собой номер источника в списке литературы (номера источников через запятую или тире, если номера идут подряд) в квадратных скобках.

10 Литература **(подробнее см. <http://www.lib.tsu.ru/win/produkcija/metodichka/1.html>)**

Список использованной литературы или использованных источников и литературы (далее список) является обязательной составной частью работы, помещается после основного текста работы и подтверждает достоверность и точность приводимых в тексте заимствований: цитат, идей, фактов, таблиц, иллюстраций, формул и других документов, на основе которых строится исследование.

Каждый документ, включенный в список, должен быть пронумерован, описан в соответствии с требованиями стандартов «Системы стандартов по информации, библиотечному и издательскому делу» (ГОСТ Р 7.0–2018, ГОСТ 7.80–2000, ГОСТ 7.82–2001, ГОСТ 7.11–2004), приведен в списке только один раз.

Заголовок списка «Литература» используется, если в список включаются все документы, изученные исследователем по теме, независимо от того, использовались они в работе или нет.

Заголовок списка «Список использованной литературы» используется, если включается только то, что анализировалось в обзоре и использовалось в виде заимствований в тексте. Заголовок списка «Список использованных источников и литературы» используется, если кроме литературы использовались и источники.

Описание документов в списке располагается в определенном порядке. В зависимости от характера, вида и целевого назначения работ допускается применять 3 варианта расположения литературы и источников в списках:

- систематическое,
- алфавитное,
- в порядке первого упоминания в тексте.

Вариант расположения литературы и источников в списке регламентируется в учебно-методических материалах по образовательной программе (Рабочая программа практики, Программа ГИА, Положение о курсовой работе, иные документы).

11 Приложения

Приложения оформляются как продолжение работы на последующих листах.

Порядок приложений соответствует порядку их упоминания в тексте.

Каждое приложение следует размещать с новой страницы с указанием в центре верхней части страницы слова «ПРИЛОЖЕНИЕ», после которого следует буква, обозначающая его последовательность.

Приложения обозначают прописными буквами кириллического алфавита, начиная с буквы А, за исключением букв Ё, Й, О, Ч, Ъ, Ы, Ь.

Приложение должно иметь заголовок, который записывают с прописной буквы, полужирным шрифтом, отдельной строкой по центру без точки в конце.

Все приложения должны быть перечислены в оглавлении.

12 Полный перечень требований к оформлению ВКР представлен в Методических указаниях к оформлению работ обучающихся НИ ТГУ, введенных в действие приказом ректора ТГУ от 14.05.2021 № 422/ОД.

ПРИЛОЖЕНИЕ Е

Шаблон заявления обучающегося на прохождение ГИА с применением ДОТ

Директору института прикладной математики
и компьютерных наук
А.В. Замятину
Обучающегося (ИПМКН, 01.04.02
Прикладная математика и информатика,
«Интеллектуальный анализ больших данных»)

(Ф.И.О. полностью)

Заявление

Прошу разрешить прохождение государственной итоговой аттестации с применением дистанционных образовательных технологий в связи

(указать причину: 1) реализация ООП в сетевой форме; 2) реализация ООП с применением исключительно электронного обучения, дистанционных образовательных технологий или в какой-либо части программы; 3) в связи с исключительными обстоятельствами (приложить копию документа, подтверждающего уважительную причину); 4) в связи с установлением особого режима работы образовательной организации)

1. Я оповещен(а) о необходимости предъявления документа, удостоверяющего личность, комиссии ГЭК для идентификации личности.

Подпись _____

2. Я подтверждаю, что обеспечен(а) всем необходимым для прохождения ГИА, а именно:
Аппаратное обеспечение:

– персональный компьютер с подключением к сети Интернет со скоростью доступа не менее 2 Мбит/с;

– web-камера, микрофон и аудиокolonки или наушники.

Программное обеспечение:

– пакет офисных приложений Microsoft Office Standard 2013 Russian (или его аналог с сопоставимым функционалом), включающий текстовый процессор Word, табличный процессор Excel, программу подготовки и просмотра презентаций PowerPoint;

– web-браузер Mozilla Firefox или Google Chrome (или их аналоги);

– система видеоконференцсвязи Adobe Connect Pro (или её аналоги с сопоставимым функционалом), поддерживающая аудио- и видеозапись сеанса связи.

С особенностями проведения ГИА с применением дистанционных образовательных технологий ознакомлен(а) и обязуюсь их обеспечить самостоятельно.

Подпись _____

3. Я согласен(а) с видеофиксацией хода проведения ГИА.

Обучающийся

И.О. Фамилия

(подпись)

« ____ » _____ 20__ г.