


Federal State Autonomous Educational Institution of Higher Education

**NATIONAL RESEARCH
TOMSK STATE UNIVERSITY**

APPROVED BY

Director of the BEP
Doctor of Physics and Mathematics, Prof.



V.P. Dyomkin

PROGRAMME OF FINAL STATE EXAMINATION

subject area

03.04.02 Physics

Profile

Physics Methods and Information Technologies in Biomedicine

Degree

Master of Science

Full-time mode of study

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Reviewed and recommended by Teaching and Learning Committee of the Faculty of Physics. Minute No6-16 dated 30.06.2016.

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TERMS AND ABBREVIATIONS

FQP – Final Qualification Paper. FQP is performed as a Bachelor's Thesis, Specialist's Thesis, or Master's Thesis.

FSE – Final State Examination is a form of assessment of students' academic performance. FSE consists of the defence of a Master's Thesis including the preparation for defence and defence itself. State exam is obligatory if it is specified by the structure of a Basic Educational Programme.

SEB – State Examination Board.

ECTS-credit – Workload according to the European Credit Transfer and Accumulation System specified by the Basic Educational Programme. One ECTS-credit equals to 36 academic hours.

NR TSU, University – National Research Tomsk State University.

BEP – Basic Educational Programme.

Director of the BEP (for Bachelor's, Master's, and Specialist's Programmes) is an academic faculty member responsible for development, implementation, and effectiveness of a BEP.

FSES HE – Federal State Educational Standard of Higher Education.

1. GENERAL PROVISIONS

1.1 Final State Examination (FSE) of graduates in NR TSU occurs upon completion of BEP *Physics Methods and Information Technologies in Biomedicine* in subject area 03.04.02 Physics. The workload of FSE is 6 ECTS-credits. According to the academic calendar, 4 weeks are provided for FSE including preparation and defence of Master's Thesis

1.2 Programme of FSE in subject area 03.04.02 Physics includes defence of Master's Thesis on one of the topics reflecting current issues in physics, medical physics, and biophysics.

1.3 FSE sets the compliance of workload and quality of graduates' professional competencies with the requirements specified by the FSES HE for professional training of graduates in subject area 03.04.02 Physics. Students that have successfully completed the BEP and passed mid-term examination specified by the curriculum are admitted to FSE.

1.4 State Examination Board (SEB) holds FSE. SEB is approved by Decree of the Rector of NR TSU.

1.5 Programme of FSE is annually reviewed and updated in accordance with amendments in Regulations. Changes to the Programme are considered at the meeting of Teaching and Learning Committee at the Faculty and are approved by the Director of a Master's Programme no later than 6 months before the date of FSE.

1.6 Programme of FSE is included into BEP *Physics Methods and Information Technologies in Biomedicine* in subject area 03.04.02 Physics. It is kept at the Department. Access to the Programme of FSE is free.

1.7 Documents that regulate the procedure of FSE in subject area 03.04.02 Physics:

- Federal State Educational Standard of Higher Education in subject area 03.04.02 Physics (Master's Degree) approved by Decree of the Ministry of Education and Science of the Russian Federation No913 dated 28 August 2015;
- Regulations of TSU on Basic Educational Programme of Higher Education at National Research Tomsk State University approved by Rector's Decree No584/OD dated 22 September 2015;
- Regulations on Bachelor's, Specialist's, and Master's Programmes in NR TSU approved by Decree of the Rector of NR TSU No 584/OD dated 22 September 2015;
- Regulations on Final State Examination in Bachelor's, Specialist's, and Master's Programmes in NR TSU approved by Decree of the Rector No827/OD dated 7 November 2016;
- BEP of Master's Programme provided by NR TSU in subject area 03.04.02 Physics, Physics Methods and Information Technologies in Biomedicine.

2. GOALS AND TASKS OF FINAL STATE EXAMINATION

2.1 Final State Examination aims to assess graduates' professional competencies developed within the BEP and their compliance with the requirements of the FSES in terms of graduates' abilities to solve tasks in professional spheres specified by the Programme.

In view of the training profile the specifics of graduates' professional activity is determined by their skills in the following fields:

- studying physical bases of operation of medical devices and diagnostic systems, principles of using supercomputer technologies in medical research;
- collecting, processing, and interpretation of multidimensional medical data to solve tasks in system biology and examine state of biosystems;
- studying methods of medical image to diagnose human health state;
- maintenance of instruments for diagnosis, treatment, rehabilitation, and prevention of diseases, and biological experiments;
- developing software to solve practical and theoretical tasks in medical and biological practices.

2.2 Tasks of Final State Examination encompass:

- assessment of graduates' abilities based on acquired knowledge, their skills and developed competencies to independently solve tasks in professional activity, professionally report specific information, defend their viewpoint and give scientific explanations;
- decision on awarding a Master's Degree and diploma of higher education according to the results of FSE;
- development of recommendations to improve the quality of training based on the results of the meeting of SEB.

3. TOPICS FOR MASTER'S THESES

1. Thresholds of motion detection.
2. Transfer function of the vestibular implant.
3. Modelling dynamic visual acuity as a function of the vestibular ocular reflex.
4. CD16-binding recombinant bispecific antibodies for multiple myeloma and breast cancer treatment, algorithms for recognition and analysis of stained tumor cell microscopic pictures.
5. Physics modelling of vestibular system in order to construct transfer function of semicircular canals.
6. Numerical modelling of atmospheric pressure plasma formed in the transition from a spark to a glow discharge in oxygen.
7. Numerical modelling of processes occurring in the human brain based on MRI and EEG.
8. Influence of autonomous and behavioral thermoregulation on health.
9. Development of a laboratory technology to monitor the effectiveness of anti-thrombotic drug.
10. New technology improvement for the Titan Krios Cryo-EM: Phase plate.
11. Oncodiagnostics based on digital X-ray 3D-microtomography and novel approaches to anti-cancer immunotherapy.
12. Type VII secretion system in Mycobacterium of tuberculosis.
13. Dependence of autonomous and behavioral thermoregulation on the age of people.

4. ORGANISING AND HOLDING FINAL STATE EXAMINATION

4.1 State examinations boards (SEB) are created to set and mark qualifications in NR TSU. SEB consists of a Chairperson and at least four members of the Board. Members of SEB are leading experts – representatives of employers and their associations in a relevant professional sphere and (or) academic faculty of NR TSU and (or) other organisations with an academic title and (or) an academic degree.

Experts (including the Chairperson) – employers and representatives of their associations in the relevant professional activity – must make up at least 50% of the total number of people included into the SEB.

4.2 Defence of Master's Thesis is held at the meeting of SEB and is open to public.

4.3 FSE for Master's Students with physical disabilities and health impairments is held taking into account their mental and physical development, individual abilities, and health status (according to p.9 of the Regulations on Final State Examination in Bachelor's, Specialist's, and Master's Programmes in NR TSU).

4.4 The use of electronic devices is strictly prohibited during examination. Videoconferencing (Skype) is allowed in FSE in Double-Degree Programmes.

4.5 Students are assigned *excellent*, *good*, *satisfactory*, or *fail* according to the results of final exams.

4.6 Upon successful completion of finals included into FSE graduates are awarded a Master's Degree and Standard Diploma established by the Ministry of Education and Science of the Russian Federation.

4.7 Graduates have a right to appeal the decision of SEB based on the results of defence. According to the rules established by p.11 of the Regulations on Final State Examination in Bachelor's, Specialist's, and Master's Programmes in NR TSU, they can submit a written appeal to the Appeal Committee.

4.8 Students missing FSE due to valid reasons (temporary disability, public or state duties, subpoena, transport-related problems (cancellation of flight, unavailability of tickets), weather conditions, or others, the list of which is independently established by institution) have the right to defend their Theses within six months after FSE.

A student missing FSE must provide satisfactory evidence to NR TSU to substantiate the reason for absence.

4.9 Students missing FSE due to invalid reasons, awarded an unsatisfactory grade, or those failed to pass FSE within the established terms are expelled from TSU. They are presented a Certificate of Training as those who have not completed the curriculum of the educational programme.

4.10 People indicated in p. 4.9 can re-sit FSE. The resit is offered no earlier than 10 month and no later than 5 years after the date of FSE. Two resits are allowed.

4.11 People indicated in p. 4.10 must apply for reinstatement in the institution for a period of study specified by the academic calendar to retake FSE in the BEP.

4.1 ORGANISING AND HOLDING DEFENCE OF MASTER'S THESIS

4.1.1 Master's Students write their Theses in accordance with a task specifying the workload and content of a Thesis (Annex 1).

4.1.2 By the Order of the Dean of the Faculty Master's Students are assigned a research supervisor from the TSU academic faculty.

4.1.3 Master's Theses must be written in English.

4.1.4 When a Master's Thesis is finished, research supervisor submits a reference letter to the Department.

4.1.5 Texts of Master's Theses are published in the e-library of the University and are checked for plagiarism.

4.1.6 To review a Master's Thesis it must be sent to one or several reviewers who are not faculty members of NR TSU twelve days prior to the date of defence. If a Master's Thesis represents an interdisciplinary study, it must be sent to several reviewers.

4.1.7 Secretary of FSE provides students with an opportunity to study review(s) and reference letter no later than five days prior to the date of defence.

4.1.8 Students are admitted to the defence by decision of the Director of BEP *Physics Methods and Information Technologies in Biomedicine* no later than three days prior to the date of defence. In case of a negative reference letter of research supervisors or reviewer(s), Master's Thesis is admitted to defence by decision of the Department made in presence of a supervisor and author of the Master's Thesis.

4.1.9 Master's Thesis, reference letters, and reviews are submitted to the SEB two days prior to the date of defence. Forms of a reference letter and submission of Master's Thesis for review are provided in Annexes 2 and 3.

4.1.10 When defending Master's Theses, graduates must demonstrate their abilities to independently solve the tasks in professional activity, present information, argue and defend their viewpoint using the acquired knowledge and skills.

5. ASSESSMENT CRITERIA OF GRADUATES' COMPETENCE AT THE DEFENCE OF MASTER'S THESIS

Excellent is awarded to graduates who perfectly studied the material of the BEP; clearly, literally, and coherently present the material at the interface of theory and practice. Graduates do not hesitate to answer the questions. They are ready to changes in the task of Master's Thesis and all types of control. Graduates demonstrate knowledge of monographs, explain their decisions, and make independent conclusions based on the results of their Master's Thesis.

Good is awarded to graduates who firmly know the material of the BEP. They give correct answers related to the topic and do not make inaccuracies. They apply theory to solve practical tasks.

Satisfactory is awarded to graduates who know only general material of the BEP. They are not aware of details, make inaccuracies and incorrect statements. Presentation of the material is incoherent. Graduates hesitate to perform practical tasks.

Fail is awarded to graduates who do not study a large part of the material of the BEP and make significant mistakes.

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
National Research Tomsk State University
Faculty of Physics
Department of General and Experimental Physics

Subject area 03.04.02

Basic educational programme:

Physics Methods and Information Technologies in Biomedicine

Approved by
Director of the BEP
Professor

_____ O.N. Demkin

_____ 20__

Assignment for research

student _____, group _____

1. Research topic _____

2. Goals and content _____

Research aims to _____

| Semester | Programme of research (type and content of activities) | Research venue |
|----------|--|----------------|
| I | | |
| II | | |

3. Deadlines for the main stages of research:

3.1 Meet the supervisor before _____

3.2 Agree the programme of research (types and content of activities) with the supervisor from NR TSU and fill in Master's Student's individual study plan and submit it to the Department before _____

3.3 Report at the meeting of the Department (report on research for the first semester) _____

3.4 Reports on completion of the tasks in Research at scientific seminars of the Laboratory for Modelling Physical Processes in Biology and Medicine in the second semester (May, June).

3.5 Report at the meeting of the Department (report on research for the second semester) _____

Research supervisor

Name and surname

Head of the Department
of General and Experimental Physics

Name and surname

Accepted for execution

Date

Name and surname

*Form of reference letter from research supervisor***REFERENCE LETTER**

On Master's Thesis

name of the topic

of the student of group _____ of the Faculty of Physics, TSU

student's name

The reference letter should provide the following information:

1. A short list of problems studied within the FQP considering the in-depth description according to the Assignment. It is reasonable to indicate the ratio of separate sections (chapters) of the Thesis and degree of their importance.
2. Description of the Thesis revealing its novelty and implementation into practice. It must be noted whether the topic is a part of state-funded, contractual or research development of the department, research organisation or production company.
3. Main advantages of the Thesis indicating the degree of student's independence in decision-making.
4. Description of the research and regulatory framework of the Thesis
5. Description of student's preparedness to independent research work.
6. Main disadvantages of the Thesis or/and presence of irrelevant material.
7. Assessment of student's activity during his/her work on the Thesis.
8. Quality of design of research materials.
9. Conclusion on awarding the student *a Master's Degree*. Total grade for the Thesis.

Research supervisor

position, academic title, degree

signature

name

Note – if a supervisor does not work at TSU, the signature must be certified by the seal of an organisation he/she works for.

*Form of submission of the Master's Thesis for review***INSTRUCTIONS FOR THE REVIEWER**

Dear _____
 State Examination Board of Tomsk State University in subject area 37.04.02 Physics ask you to write a review on Master's Thesis _____
 performed by the student of group _____ of the Faculty of Physics, TSU _____

The dissertation and review must be submitted to the State Examination Board before _____ 20____.

The defence will be held _____, room _____

Your attendance is requested for the defence.

The review must provide the following information:

1. Conclusion on the compliance of the Master's Thesis with the Assignment.
2. Novelty of the topic.
3. Essence of the results and their contribution to the field of study.
4. Validity of the results and their theoretical and practical significance.
5. Degree of research completion; recommendations for practical application and publishing.
6. Design and representation of the FQP according to the criteria:
 - summary of the literature, presentation of the latest data (3-5 years);
 - relevance of the methods and their conformity to the problem;
 - depth of discussion of the results and correctness of solutions;
 - concise and meaningful conclusions on the work;
 - scientific register of writing, literacy, design of the paper;
 - design of illustrations, tables and other illustrative materials according to the standards;
 - proper citation.
7. Conclusion on awarding a Master's Degree and reasoning of the grade.

Write the place of employment, position, signature, and name at the end of the review.

_____ 20____

Chairperson of the State Examination Board

_____ name