Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology (National Research University)"

APPROVED
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Programme for the final state attestation (defence of the graduation thesis)
Performance of and Defence of Graduation Thesis/Выполнение и защита выпускной квалификационной работы

by direction (speciality):	Applied Mathematics and Physics
orientation (profile):	Applied Bioinformatics/Прикладная биоинформатика Phystech School of Biological and Medical Physics
course:	2
qualification:	Master
semester:	4 (Spring)

The programme was drawn up by: K.A. Provotorova

The programme was discussed at a meeting Phystech School of Biological and Medical Physics 04.06.2020

1. Goals and objectives

Goals

The purpose of the state final certification (hereinafter - GIA) is to establish the level of preparation of the student to perform professional tasks and the compliance of the results of mastering the educational program with the requirements of the educational standard in the direction of training.

Objectives

- assessment of the student's ability, relying on the acquired knowledge, skills, and formed competencies, to independently solve problems from the field of their professional activities at a modern level, to professionally present special information, correctly argue and defend their point of view;
- making a decision on awarding the graduate with the qualification "Bachelor" / "Master" / "Specialist" based on the results of the SIA and issuance of a document (diploma) on higher education to the graduate;
- development of recommendations for improving the training of graduates in this area of training based on the results of the work of the state examination commission.

2. List of competences, the level of which is assessed in the defence of the graduation thesis

As a result of mastering the educational programme a graduate should develop universal / general cultural, general professional and professional competences. The competences are assessed in the course of interim certification of disciplines (modules), practices. During the defence of the graduation thesis graduates should demonstrate the following competences:

Code and name of competence	Indicators of competence achievement
Gen.Pro.C-4 Successfully perform a task, analyze the results, and present conclusions, apply knowledge and skills in the field of physical and mathematical sciences and ICTs	Gen.Pro.C-4.1 Apply ICT knowledge and skills to find and study scientific literature and use software products
	Gen.Pro.C-4.2 Apply knowledge in the field of physical and mathematical sciences to solve problems, make conclusions, and evaluate the obtained results
	Gen.Pro.C-4.3 Justify the chosen method of scientific research
Pro.C-1 Assign, formalize, and solve tasks, develop and research mathematical models of the studied phenomena and processes, systematically analyze scientific problems and obtain new scientific results	Pro.C-1.1 Locate, analyze, and summarize information on current research findings within the subject area
	Pro.C-1.2 Make hypotheses, build mathematical models of the studied phenomena and processes, evaluate the quality of the developed model
	Pro.C-1.3 Apply theoretical and/or experimental research methods to a specific scientific task and interpret the obtained results
Pro.C-3 Use research and testing equipment (devices and installations, specialized software) in a selected subject field	Pro.C-3.1 Understand the operating principles of the equipment and specialized software
	Pro.C-3.2 Conduct an experiment (simulation) using research equipment (software)
	Pro.C-3.3 Evaluate the accuracy of the experimental (numerical) results

3. Topics for final qualification theses

The subject of the FQP is developed by the graduating departments on the basis of topical problems of the industry and trends in the development of science in the field of training.

Sample WRC topics:

Department of Physical and Chemical Biology and Biotechnology

Morpho-functional changes in astrocytes in normal and pathological conditions

Calculation of NMR relaxation parameters of side chains from molecular modeling data

Department of Bioinformatics and Systems Biology

Identification of gene coevolution using functional pathways

Identification of new genetic loci associated with Fuchs corneal endothelial dystrophy

Department of Molecular and Translational Medicine

Inhibition of Chlamydia infection by activating the expression of genes of human pethidoglycan recognition proteins in HeLa cells

Genomic G4 Sites - Targets for Epigenetic Therapy

Department of Molecular and Cellular Biology

Search for factors of reprogramming of human skin cells into hematopoietic stem cells using CRISPR-a screening

The use of the architectural protein CTCF with an artificial DNA-binding domain for modifying the genome topology in health and disease

Department of Technological Entrepreneurship

Evaluation of financial and economic indicators of the effectiveness of the implementation of user behavior analytics systems in Acronis

Development of a platform for the detection of markers of cancer

center for educational programs in bioinformatics

Analysis of associations of mutational loci with paranoid schizophrenia

Transcriptome analysis of immune cell populations

Department of Innovative Pharmaceuticals, Medical Technology and Biotechnology

Development of a method for determining the falsification of cow's milk

Search and characterization of new plant HPPD inhibitors

4. Requirements for the text of a graduation thesis

The text of the final qualifying work is drawn up in accordance with the requirements of the Regulations on the final qualifying work of MIPT students and the Requirements for the content and structure, the rules for issuing the FQP (bachelor's and master's theses) of students of the FBMF.

5. The procedure for defending a graduation thesis

The main questions on the defense of FQP are regulated by the Regulations on the final qualifying work of MIPT students.

The defense of the final qualifying work is carried out in the form of a report on the results of the scientific research (presentation). The duration of the student's report is no more than 15 minutes. At the end of the report, the student answers the questions of the SEC members without additional preparation time. The student's survey cannot last more than 1 astronomical hour.

Sample questions from members of the State Electoral Commission for the defense of the WRC:

1. What sources did you use when searching for scientific information on the topic of your research?
2. In which publications are the results of your work published?
3. What mathematical models did you use when processing research results?
4. What is the novelty of your research results? How would you characterize this novelty: a concept, an idea that enriches a well-known concept, or as a new technique that expands the boundaries of knowledge?
5. At what conferences were the results of your work presented?
6. Why did you choose this particular method for research?
7. What is the error of your chosen analysis method? Show the confidence interval on a graph.
8. Describe your chosen research method.
9. How was the processing of the experimental data carried out?
10. What is the reliability of your results?
11. Formulate the practical value of your research.

12. What is your contribution to the results of scientific works published by the team with your participation?

13. What justifies the theoretical significance of the results of your research?

14. What justified the practical significance of the results of your research?

15. Your forecast for the prospects of using the results of your work.

16. What new scientific facts (factors, hypotheses, tendencies, positions, ideas, proofs) are presented in your work?

17. Did you manage to reveal essential contradictions in the known concepts of the subject studied by you (the studied phenomenon, the studied process) in the FQP, if you succeeded, then what are they?

18. What is the result of comparing your author's scientific achievements with the data presented in independent sources on this topic?

19. What software did you use when performing the work and processing the results?

20. How did you substantiate in your work the representativeness of the sample sets of units of observation (measurement)?

21. Can you state that there is a consistent research plan on the topic of WRCs? What did you fail in implementing it?

The graduating department organizes the necessary consultations for students, explains the principles and procedure for conducting the GIA, the criteria for evaluating the answers, the procedure for appealing, and also gives answers in essence to all questions that arose in preparation for the GIA.

6. Description of the facilities required for the defence of a graduation thesis

–The audience for the defense of the final qualifying work, equipped with workplaces for students and the state examination committee, a blackboard, multimedia equipment.

7. List of recommended reading

Main literature

1. Подготовка и защита бакалаврской работы, магистерской диссертации, дипломного проекта [Электронный ресурс], учеб. пособие / Ю. Н. Новиков. — СПб., Лань, 2019.— URL: https://e.lanbook.com/book/122187 (дата обращения: 29.01.2021). - Полный текст (Режим доступа : из сети МФТИ / Удаленный доступ)

Book title in english:

Novikov, YN Preparation and defense of bachelor's work, master's thesis, diploma project [Electronic resource]: textbook. allowance / Yu. N. Novikov. - 4th ed., Stereotype. - SPb .: Lan, 2019.

Additional literature

1. Искусство писать научные статьи, научно-практическое руководство / Е. З. Мейлихов. — Долгопрудный, Интеллект, 2020.— URL: http://books.mipt.ru/book/301312 (дата обращения: 18.12.2020). - Полный текст (Режим доступа : из сети МФТИ / Удаленный доступ)

Book title in english:

Meilikhov, EZ The art of writing scientific articles [Electronic resource]: scientific-practical. leadership / EZ Meilikhov. - Dolgoprudny: Intellect, 2020

8. Guidelines for students on completion of the thesis and preparation for the defence

The results of the FQP defense are determined by the marks "excellent", "good", "satisfactory", "unsatisfactory". The marks “excellent”, “good”, “satisfactory” mean the successful defense of the WRC with the assignment of the corresponding qualifications.

The grade for the FQP is given by the GEC taking into account the opinion of the scientific supervisor, the graduate's report and public discussion, as well as taking into account the following criteria:

- the validity of the relevance of the research topic, the correspondence of the content to the topic, the completeness of its disclosure;

- the clarity of the structure of the work and the consistency of the presentation of the material, the methodological validity of the research;
- the effectiveness of using the selected research methods to solve the problem;
- possession of the scientific style of presentation;
- the validity and value of the research results and conclusions obtained, the possibility of their application in practice;
- compliance of the FQP submission form with all the requirements for registration of works;
- the quality of the oral presentation, fluency in the material of the WRC;
- the depth and accuracy of answers to questions, comments and recommendations during the defense of the work.

When evaluating FQPs, publications, copyright certificates, etc. can be taken into account.

The criteria for assessing the defense of FQP are given in the Regulations on the final qualifying work of MIPT students.

9. Methodology and assessment criteria for the defence of the graduation thesis

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The grade for the FQP is given by the GEC taking into account the opinion of the scientific supervisor, the graduate's report and public discussion, as well as taking into account the following criteria:

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- the clarity of the structure of the work and the consistency of the presentation of the material, the methodological validity of the study;
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- compliance of the FQP submission form with all the requirements for registration of works;
- the quality of the oral presentation, fluency in the material of the WRC;
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10. Peculiarities of final state examinations for persons with disabilities and persons with special needs

For students with disabilities, the final state attestation takes into account the particularities of their psycho-physical development, their individual capacities and health status (hereinafter referred to as "individual characteristics").

The following general requirements shall be ensured in the conduct of the FSA:

– Conducting state final examinations for persons with disabilities in the same room as students without disabilities, if this does not create difficulties for the students when taking the FSA;

– presence of assistant(s) in the classroom to provide students with disabilities with the necessary technical assistance, taking into account their individual characteristics (to take the workplace, move around, read and complete an assignment, communicate with members of the SEC);

– The use of technical aids for students with disabilities in taking the FSA, taking into account their individual characteristics;

– Ensure that students with disabilities have unhindered access to and stay in classrooms, toilets and other facilities.

At the written request of a student with a disability, the length of the student's speech at the defence of the final qualification thesis shall not exceed 15 minutes.

A student with a disability shall submit a written application no later than 3 months prior to the commencement of the State Attestation Examination regarding the need to arrange special conditions for him/her when conducting state attestation tests, indicating the specifics of his/her psychophysical development, individual capabilities and state of health. The application shall be accompanied by documents confirming the learner's individual characteristics (in the absence of these documents in the Directorate of the Institute).

In the application, the student indicates the need (or lack of need) for an assistant to be present at the state certification examination, the need (or lack of need) to increase the length of the presentation during the defence of the graduation thesis in relation to the prescribed duration.