

**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): Beam-Plasma Systems and Technologies/Пучково-плазменные системы и технологии
Chair of Logistics Systems and Technologies
course: 2
qualification: Master

semester: 4 (Spring)

Программу составили:

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The programme was discussed at a meeting Chair of Logistics Systems and Technologies 09.02.2022

1. Goals and objectives

Goals

The aim of the State Final Attestation (hereinafter - SFA) is to determine the level of preparedness of the student to perform professional tasks, and compliance of the results of mastering the educational program with the requirements of the educational standard in the field of study.

Objectives

- To assess the student's ability to independently solve problems in his or her professional area of work on the basis of acquired knowledge, skills and competences, to present specialised information professionally, to argue and defend his or her point of view correctly;
- To take a decision on awarding a graduate the qualification "Master" based on the results of the SFA and on issuing a graduate document (diploma) on higher education; - development of recommendations on improving the training of graduates in this particular field of study 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
UC-1 Use a systematic approach to critically analyze a problem, and develop an action plan	UC-1.1 Systematically analyze the problem situation, identify its components and the relations between them
	UC-1.2 Search for solutions by using available sources
	UC-1.3 Develop a step-by-step strategy for achieving a goal, foresee the result of each step, evaluate the overall impact on the planned activity and its participants
UC-2 Able to manage the project through all stages of implementation	UC-2.1 Set an objective within a defined scientific problem; formulate the agenda, relevance, significance (scientific, practical, methodological, or other depending on the project type), forecast the expected results and possible areas of their application
	UC-2.2 Forecast the project outcomes, plan necessary steps to achieve the outcomes, chart the project schedule and monitoring plan
	UC-2.3 Organize and coordinate the work of project stakeholders, provide the team with necessary resources
	UC-2.4 Publicly present the project results (or results of its stages) via reports, articles, presentations at scientific conferences, seminars, and similar events
UC-3 Organize and manage a team, and develop the team strategy to achieve the objectives	UC-3.1 Organize and coordinate the work of the project stakeholders and help resolve disputes and conflicts
	UC-3.2 Consider the interests, specific behavior, and diversity of opinions of team members/colleagues/counterparties
	UC-3.3 Foresee the results (consequences) of both individual and collective actions
	UC-3.4 Plan teamwork, distribute tasks to team members, hold discussions of different ideas and opinions
	UC-4.1 Exchange business information in oral and written forms in Russian and at least one foreign language

UC-4 Use modern communication tools in the academic and professional fields, including those in a foreign language	UC-4.2 Use the acquired skills to write, translate, and edit various academic texts (abstracts, essays, reviews, articles, etc.)
	UC-4.3 Present the results of academic and professional activities at various academic events, including international conferences
	UC-4.4 Use modern ICT tools for academic and professional collaboration
UC-5.1 Analyze and consider cultural diversity in intercultural interactions	UC-5.1 Identify specific philosophical and scientific traditions in major world cultures
	UC-5.2 Define the theoretical and practical significance of cultural and linguistic factors within various interrelated philosophical and scientific traditions
UC-6 Determine priorities and ways to improve performance through self-assessment	UC-6.2 Evaluate performance results in correlation with the set objectives and applied methods
	UC-6.1 Achieve personal growth and professional development, determine priorities and ways to improve performance
Gen.Pro.C-1 Gain fundamental scientific knowledge in the field of physical and mathematical sciences	Gen.Pro.C-1.1 Apply fundamental scientific knowledge in the field of physical and mathematical sciences
	Gen.Pro.C-1.2 Consolidate and critically assess professional experience and research findings
	Gen.Pro.C-1.3 Understand interdisciplinary relations in applied mathematics and computer science and apply them in professional settings
Gen.Pro.C-2 Acquire an understanding of current scientific and technological challenges in professional settings, and scientifically formulate professional objectives	Gen.Pro.C-2.1 Assess the current state of mathematical research within professional settings
	Gen.Pro.C-2.2 Assess the relevance and practical importance of research in professional settings
	Gen.Pro.C-2.3 Understand professional terminology used in modern scientific and technical literature and present scientific results in oral and written form within professional communication
Gen.Pro.C-3 Select and/or develop approaches to professional problem-solving with consideration to the limitations and specifics of different solution methods	Gen.Pro.C-3.1 Analyze problems, plan research strategy to achieve solution(s), propose, and combine solution approaches
	Gen.Pro.C-3.2 Employ research methods to solve new problems and apply knowledge from various fields of science (technology)
	Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations of the implementation of the obtained solutions in practice
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
Gen.Pro.C-5 Undertake professional training, achieve professional growth, and become a team leader in a professional sphere, tolerant of social, ethnic, religious, and cultural differences	Gen.Pro.C-5.1 Tolerate social, ethnic, religious, and cultural differences in teamwork
	Gen.Pro.C-5.2 Manage a small professional team
	Gen.Pro.C-5.3 Apply new knowledge and achieve personal and professional growth

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-2 Organize and conduct scientific research and testing independently or as a member (leader) of a small research team	Pro.C-2.1 Plan and conduct scientific research independently or as part of a research team
	Pro.C-2.2 Test research results through scientific publications and participation in conferences
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

Graduation Thesis Themes correspond to the scientific problems in area of Chemical physics

Graduation Thesis Themes Examples:

- Production of functional coatings and hybrid polymer materials by means of combined plasma
- Study of the influence of non-thermal plasma on synthetic and bioorganic polymers
- Generators of Hybrid Plasmas for Industrial Technologies

4. Requirements for the text of a graduation thesis

The text of the graduate qualification work shall be prepared in accordance with the requirements of the Regulations on the Final Qualification Paper of MIPT Students and the Requirements for the Content and Structure.

5. The procedure for defending a graduation thesis

The main issues of defending a FQP are regulated by the Regulations on the Final Qualification Paper of MIPT Students.

The defence of the final qualification paper is carried out in the form of a report on the results of the research (a presentation). The duration of oral presentation shall be no more than 15 minutes. At the end of the report the student answers questions from the members of the SEC (state examination commission) without additional preparation time. The student may not be questioned for more than 1 clock hour.

Sample questions from SEC members at the defence of a FQP:

1. What sources did you use when searching for scientific information on the topic of your research?
2. In which publications have the results of your work been published?
3. What mathematical models did you use to process the research results?

4. What is the novelty of your research results? How would you characterise this novelty: as a concept, as an idea that enriches a known concept, or as a new methodology that expands the boundaries of knowledge?
5. At which conferences have the results of your work been presented?
6. Why did you choose this particular methodology for your research?
7. What is the error limit of the analysis method you have chosen? Show the confidence interval on the graph.
8. Characterise the research method you have chosen.
9. How was the experimental data processed?
10. What is the reliability of your results?
11. Characterise the practical value of your research.
12. What is your contribution to the results of the research papers published by the team with your participation?
13. What substantiates the theoretical significance of your research findings?
14. What substantiates the practical relevance of your research findings?
15. Your prognosis for the prospects of applying the results of your work.
16. Which new scientific facts (factors, hypotheses, trends, statements, ideas, evidence) are stated in your paper?
17. Did you manage to identify significant contradictions in the known ideas about the subject (phenomenon or process under study) in your thesis, if so, what are they?
18. What is the result of comparing your author's scientific achievements with the data presented in independent sources on the subject?
19. What software did you use to carry out your work and process your results?
20. How have you validated the representativeness of the samples of observation (measurement) units in your paper?

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

A classroom for the defence of the final qualification paper, equipped with workplaces for students and the State Examination Commission, a blackboard and 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)

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)

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

The completion of a FQP and preparation for its defence should be guided by the Procedure for the State Final Attestation for Higher Education Programmes - Bachelor's, Specialist's and Master's Degree Programmes at MIPT (https://mipt.ru/sveden/files/Poryadok_provedeniya_GIA_v_bakalavriate,_specialitete_i_magistrature_2 7.11.2017.pdf) and the Regulations on the Final Qualification Paper of MIPT Students.

In the course of writing an FQP, the student must demonstrate the ability to systematise, generalise, consolidate and expand theoretical knowledge and practical skills; to research a specific problem in depth and independently; to apply the acquired knowledge to solving specific problems of professional activity; to develop practical recommendations in the studied field; and to present the results of his/her activity.

FQPs must demonstrate the level of preparedness for independent professional activity and is a presentation of the results of his/her research related to the solution of the tasks of the type of professional activity which is the focus of the study programme. An FQP submitted for defence must be presented in compliance with the principles of logic, argumentation and consistency, and be based on the study of theoretical and factual material, the ability to argue own proposals and use special terms correctly.

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

The results of the defence of a FQP are defined by the grades 'excellent', 'good', 'satisfactory' and 'unsatisfactory'. The grades "excellent", "good" and "satisfactory" mean that the FQP has been successfully defended and a correspondent qualification has been awarded.

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

- justification of the relevance of the research topic, relevance of the content, completeness of its elucidation;
- the clear structure of the work and the logical presentation of the material, the methodological validity of the research;
- the effectiveness of the chosen research methods for the solution of the problem;
- mastery of scientific style of presentation;
- validity and value of the research results and conclusions, the possibility of their application in practice;
- compliance of the form of presentation of the FQP with all the requirements for the layout of such papers;
- the quality of the oral report, fluency in the material of the FQP;
- depth and accuracy of answers to questions, comments and recommendations during the defence of the paper.

Publications, author's certificates, etc. can be taken into account during the evaluation of an FQP.

The evaluation criteria for the defence of an FQP can be found in the Regulation on Final Qualification Papers of MIPT Students.

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").

10.1. 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.

10.2. 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.

10.3. 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.