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

Practice program

course:	Personal Research Project/Научно-исследовательская работа
major:	Information Science and Computer Engineering
specialization:	Computer Science/Информатика
	Физтех-школа Прикладной Математики и Информатики
	Phystech School of Applied Mathematics and Informatics
term:	4
qualification:	Bachelor
type of practice:	industrial
practice method:	mipt-based

Semesters, forms of interim assessment:

7 (fall) - Grading test

8 (spring) - Grading test

Author of the program: A.M. Raygorodskiy, doctor of physics and mathematical sciences, associate professor

The program was discussed at the   Phystech School of Applied Mathematics and Informatics 05.06.2023

Annotation

Research work is an integral part of the educational process, designed to ensure a close connection between scientific and theoretical and practical training, to give students the experience of practical activities in accordance with the profile of the program.

The practice is carried out in scientific laboratories of basic and faculty and institute departments of the Physics and Technology School of Applied Mathematics and Informatics.

1. General characteristics of practice

Purpose of the course

The purpose of the practice is to obtain professional skills and experience in professional activities. The practice provides practical training for students and is aimed at the formation, consolidation, development of practical skills and competencies in the profile of the educational program.

Also, the main goal of the research work of students is to develop the ability to independently perform research work related to solving professional problems necessary in further professional activity.

Research work is carried out by the student under the guidance of a scientific advisor. The direction of research work is determined in accordance with the profile of the educational program.

In the case of internship at the base department, the student's supervisor (head of the FQP) acts as the head of the internship

Purpose of practice

The objectives of the practice are:

–Development of professional research thinking of students, the formation of a clear idea of the main professional tasks and ways to solve them;

- formation of the ability to independently perform laboratory, computational research in solving professional problems using modern research methods, modern equipment and computing facilities;

- formation of the ability to competently use modern technologies for collecting information, processing and interpreting the obtained experimental data.

During the period of practice, the student must study:

–Information sources on the topic being developed for the purpose of their use in the performance of the final qualifying work;

–Methods of analysis and processing of statistical data;

–Information technologies used in scientific research, software products related to the professional sphere;

–Requirements for the design of scientific and technical documentation;

execute:

–Analysis, systematization and generalization of information on the topic of research, including bibliographic work on a given topic using modern information technologies;

–Comparison of the research results of the object of development with domestic and foreign analogues;

–Analysis of the scientific and practical significance of the research;

- a report on the work done.

Forms of practice: dispersed

2. List of the planned results of the practice

Mastering the discipline is aimed at the formation of the following competencies:

Code and the name of the competence	Competency indicators
UC-1 Search and identify, critically assess and synthesize information, apply a systematic approach to problem-solving	UC-1.1 Analyze problems, highlight the stages of their solution, plan actions required to solve them
	UC-1.2 Find, critically assess, and select information required for the task in hand
	UC-1.3 Consider various options for solving a problem, assess the advantages and disadvantages of each option
	UC-1.4 Make competent judgments and estimates supported by logic and reasoning

	UC-1.5 Identify and evaluate practical consequences of possible solutions to a problem
UC-2 Determine the range of tasks for the set goal and select the best way(s) to solve them, based on current legal regulations, available resources, and constraints	UC-2.1 Determine a set of interrelated tasks required to achieve the current objective, define the expected results of these tasks
	UC-2.2 Work out a solution to a specific task within a project, selecting the best way(s) to solve it, based on current legal regulations, available resources, and constraints
UC-3 Interact effectively with project team members and fulfill one's role properly	UC-3.1 Establish different types of communication (educational, scientific, business, informal, etc.)
	UC-3.2 Interact with other team members to fulfill the project objectives
Gen.Pro.C-2 Use modern IT and software tools to perform professional tasks in compliance with information security requirements	Gen.Pro.C-2.1 Apply modern computing tools and Internet services in professional settings
	Gen.Pro.C-2.2 Apply numerical mathematical methods and use software applications for scientific problem-solving in professional settings
	Gen.Pro.C-2.3 Fulfill basic information security requirements
Gen.Pro.C-3 Write scientific and/or technical (technological, innovative) reports (publications, projects)	Gen.Pro.C-3.1 Meet the general criteria for submission of manuscripts, scientific and technical documentation and use relevant software applications
	Gen.Pro.C-3.2 Employ practical methodologies for preparing scientific and technical reports (projects)
	Gen.Pro.C-3.3 Visually and graphically present scientific (scientific and technical, innovative technological) outcomes in the form of reports, scientific publications
Gen.Pro.C-5 Participate in fundamental and applied research and development activities; independently develop new theoretical research methods (including mathematical research methods) and work with modern experimental scientific research, measuring and analytical, and technological equipment	Gen.Pro.C-5.1 Perform tasks in the field of theoretical and experimental research and development activities
	Gen.Pro.C-5.2 Apply new knowledge through the study of literature, scientific articles, and other sources
	Gen.Pro.C-5.3 Professionally use modern experimental scientific research (measuring and analytical, technological) equipment
Pro.C-1 Assign, formalize, and solve tasks, develop and research mathematical models of the studied phenomena and processes, systematically analyze scientific problems, obtain new scientific outcomes	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 Conduct scientific research and testing independently or as a member (leader) of a small research team	Pro.C-2.1 Apply the principles of scientific work, methods of collecting and analyzing the obtained data and ways of argumentation
	Pro.C-2.2 Conduct scientific research independently or as a member (leader) of a small research team
	Pro.C-2.3 Present research results through scientific publications and participation in conferences

3. List of the planned results of the practice

As a result of studying the course the student should:

know:

– Approaches to the organization of independent and collective research work;
– principles of organizing experiments and tests;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

be able to:

– to carry out search, processing, analysis and systematization of scientific and technical information, to select methods and means of solving problems set by the research program;
– perform processing and analysis of the results of experiments and tests;
– analyze the difficulties arising in research activities and contribute to their resolution;
– to design a solution to a research problem, based on current legal regulations and available resources and restrictions;
– to formalize and present the results of research work.

master:

–the skills of preparing plans and programs for conducting scientific research, technical developments, assignments for performers.

4. Practice content
4.1. Main stages of practice

№	Practice stage content	Labor intensity (hours), including independent work
		7 semester
1	Formulation of the problem	190
2	Collection, processing, analysis and systematization of scientific and technical information on the research topic	290
3	Scientific research and analysis of the result	285
Total AH in 7 semester		765
		8 semester
4	Preparation of the final report	150
5	Preparation and conduct of scientific research	150
6	Preparation of interim report	150
Total AH in 8 semester		450
AH in total		1 215

4.2. Work content

Semester: 7 (Fall)

1. Formulation of the problem

Conducting a safety briefing, familiarizing students with the internal regulations. Setting a research task, drawing up a plan of practice, developing a research program.

2. Collection, processing, analysis and systematization of scientific and technical information on the research topic

Study of scientific, periodical (including foreign) literature on the research topic. Selection and justification of the accepted direction of research. Preparation of an analytical review. Formulation of the goals and objectives of the study. Planning experimental research.

3. Scientific research and analysis of the result

Preparation and implementation of scientific research (continuation of the work begun in the previous semester), data processing and analysis of the results.

Semester: 8 (Spring)

4. Preparation of the final report

Preparation of a report on practice based on the results obtained, presentation at a scientific seminar / meeting of the department.

5. Preparation and conduct of scientific research

Preparation and implementation of experimental and / or theoretical scientific research within the framework of the task.

6. Preparation of interim report

Preparation of an interim report on practice for a semester based on the results of mastering the practice.

4.3. Practice supervision

The practice is managed by the student's appointed scientific advisor, whose duties include:
–Scientific and educational-methodical management of research work;
–Development of individual tasks for students, performed during the practice period;
–Provision of assistance to students in the development of a plan for conducting research;
–Conducting consultations (research seminar, lectures) on conducting research;
- control over the implementation of the research plan;
- verification of the reporting documentation on the implementation of research work.

Discussion of the plan and intermediate results of research is carried out at the department that prepares students, as well as within the framework of the scientific seminar of the department and organizations with which cooperation is conducted and on the basis of which research can be carried out.
The results of research work should be drawn up in the form of a report and submitted for consideration and approval to the supervisor. Attached to the report (if any) is a list of articles and abstracts of the student's reports published on the topicисследования, а также список докладов и выступлений studying at scientific conferences and seminars. Lists of published works and speeches are accompanied by supporting documents (reprints of articles, photocopies of abstracts, as well as certificates of participation in conferences or the conference program).
Based on the results of the research work, the supervisor gives the student an assessment.

5. Description of the material and technical facilities that are necessary for the implementation of the educational process of the course (training module)

To carry out the practice, you need: a workplace in an educational or scientific unit, which is a place of practice, a workplace for independent work, containing a personal computer, with access to the Internet and the MIPT electronic educational environment.
Place of practice: scientific laboratories of the basic and faculty departments of the Physics and Technology School of Applied Mathematics and Informatics.

6. List of the main and additional literature, that is necessary for the course (training module) mastering

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)

7. List of curricular resources for independent work on practice

1. Questel Orbit https://www.orbit.com/ – объединяет около 100 баз данных, предназначенных специалистам в области патентоведения и широкому кругу исследователей. Основная патентная база FamPat содержит данные 95 патентных ведомств всех регионов мира; патенты объединены в семьи по тематическому признаку.

2. Inspec Analytics – аналитический модуль базы данных Inspec https://inspec-analytics-app.theiet.org/. Inspec Analytics позволяет визуализировать результаты поиска, сравнивать полученные результаты на уровне учреждений, авторов, тематик по количеству публикаций.

3. Sage journals – более 100 журналов доступно в полнотекстовом режиме в области естественных наук, техники и медицины. https://journals.sagepub.com/action/doSearch?filterOption=allJournal&AllField=research&content=journalTitle&target=titleSearch&pageSize=100&startPage=0

4. Taylor&Francis journals – более 2000 журналов по всем областям знаний. Журналы разделены по коллекциям в области STM наук (Science, Technology & Medicine) и HSS (Humanities & Social Sciences), а также по более узким, конкретным областям знаний, https://www.tandfonline.com/action/doSearch?AllField=research&startPage=&target=titleSearch&content=title

http://www.consultant.ru/
https://www.fips.ru/
https://patents.google.com/
https://www.wipo.int/portal/ru/

8. List of web resources that are necessary for the practice mastering

Database:
–Referential-bibliographic and scientometric (bibliometric) database Web of Science Core Collection;
–Abstract and scientometric database (citation index) Scopus.
Electronic libraries:
–RFBR electronic library - https://www.rfbr.ru/rffi/ru/library;
–Scientific electronic library - https://elibrary.ru.

9. Guidelines for students to master the cource

The assignment for practice is determined by the supervisor, taking into account the specifics of the research work of the department or the base enterprise. The basis of the content of the student's independent work during the implementation of the practice program is the development of methods,приемов, technologies for analyzing and systematizing scientific and technical information, developing plans and programs for conducting scientific research and acquiring practical skills in carrying out research activities, taking into account the interests and capabilities of the departmentили базового предприятия, где it is being carried out. When completing an individual assignment, the student must combine practical work on the subject of the assignment with a theoretical study of the issue using the recommended information resources. When working with literary sources, it is recommended to draw up a short synopsis with the obligatory fixation of the bibliographic data of the source. Research work ends with writing a report.

Assessment funds for practice

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term:	4
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Semesters, forms of interim assessment:

> 7 (fall) - Grading test
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> 8 (spring) - Grading test

Author:	A.M. Raygorodskiy, doctor of physics and mathematical sciences, associate professor

1. Competencies formed during the process of studying the practice

Code and the name of the competence	Competency indicators
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	Pro.C-2.2 Conduct scientific research independently or as a member (leader) of a small research team

	Pro.C-2.3 Present research results through scientific publications and participation in conferences

2. Competency assessment indicators

As a result of studying the course the student should:

know:
– Approaches to the organization of independent and collective research work;
– principles of organizing experiments and tests;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

be able to:
– to carry out search, processing, analysis and systematization of scientific and technical information, to select methods and means of solving problems set by the research program;
– perform processing and analysis of the results of experiments and tests;
– analyze the difficulties arising in research activities and contribute to their resolution;
– to design a solution to a research problem, based on current legal regulations and available resources and restrictions;
– to formalize and present the results of research work.

master:
–the skills of preparing plans and programs for conducting scientific research, technical developments, assignments for performers.

3. Student practice reporting

Interim certification in practice is carried out in the form of a differentiated test and an exam.

During the period of practice, the student is obliged:

- Completely fulfill the research plan;

- follow the instructions of the head of research work;

- be responsible for the work performed and its results.

Assessment for industrial practice - research work - is given to the student by the scientific supervisor based on the results of the defense of his work. The defense of research work is carried out in the form of a scientific seminar of the department. When evaluating research work, the following is taken into account:

- implementation of the research plan;

- presentation of research results;

- R&D report of the established form (Appendix 1).

The mark "excellent" (8-10 points) is given if the individual task is completed in full, the student has shown a high level of independence and a creative approach to its implementation.

The mark "good" (5-7 points) is given if the individual task is completed in full, there are some shortcomings in the design of the presented material.

The mark "satisfactory" (3-4 points) is given if the task as a whole is completed, but there are shortcomings in the implementation of individual sections (parts) of the task during practice, there are comments on the design of the collected material.

The mark "unsatisfactory" (1-2 points) is given if the task is completed only partially, there are numerous comments on the design of the collected material.

Форма отчета о прохождении практики

<table>
<tr><td colspan="2">ОТЧЕТ
о прохождении производственной практики– научно-исследовательской работы
_____семестр, ____/____учебный год</td></tr>
<tr><td>ФИО обучающегося</td><td></td></tr>
<tr><td>Физтех-школа, группа</td><td></td></tr>
<tr><td>Место прохождения практики</td><td></td></tr>
<tr><td>Задание на практику</td><td></td></tr>
<tr><td>Отчет (проделанная работа и полученные результаты)</td><td></td></tr>
<tr><td>Отзыв руководителя о работе обучающегося</td><td></td></tr>
<tr><td>Оценка руководителя за работу обучающегося</td><td></td></tr>
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Обучающийся   _____   дата   составления   отчета
_____
Контактный телефон: 8-9__-___-__-__

Научный руководитель _____ /_____/
Контактный телефон: 8-9__-___-__-__ e-mail:
Зав. кафедрой   _____ /_____/