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

APPROVED
Head of the Phystech School of Applied Mathematics and Informatics
A.M. Raygorodskiy

Work program of the course (training module)

course:	Scientific Workshop: Modern Topics in Applied Mathematics and Computer Science/Научный семинар: Современные проблемы прикладной математики и информатики
major:	Applied Mathematics and Informatics
specialization:	Contemporary Combinatorics/Современная комбинаторика
	“Pusk” Online and Supplementary Education Centre
	Phystech School of Applied Mathematics and Informatics
term:	1
qualification:	Master

Semester, form of interim assessment: 1 (fall) - Grading test

Academic hours: 15 AH in total, including:
lectures: 0 AH.
seminars: 15 AH.
laboratory practical: 0 AH.

Independent work: 30 AH.

In total: 45 AH, credits in total: 1

Author of the program: E.G. Molchanov, candidate of physics and mathematical sciences, associate professor

The program was discussed at the Phystech School of Applied Mathematics and Informatics 08.04.2022

Annotation

This course is dedicated to students obtaining fundamental knowledge in the field of their applied activities, getting acquainted with the latest results of scientific research, teaching the principles of writing scientific articles and preparing scientific reports and presentations.

1. Study objective

Purpose of the course

Obtaining fundamental knowledge by students in the field of their applied activities, familiarization with the latest results of scientific research, teaching the principles of writing scientific papers and preparing scientific reports and presentations.

Tasks of the course

- Familiarization of students with the latest achievements in the scientific field;
- teaching students the methodology of writing scientific papers, reports and presentations;
- formation of approaches to the implementation of research by students in the framework of final works for a master's degree and the rules for preparing master's theses.

2. List of the planned results of the course (training module), correlated with the planned results of the mastering the educational program

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

Code and the name of the competence	Competency indicators
Gen.Pro.C-1 Address current challenges in fundamental and applied mathematics	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 tasks
Gen.Pro.C-3 Develop mathematical models and conduct their analysis in the processes of professional problem-solving	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 science and technology fields
	Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations for applying the obtained solutions
	Gen.Pro.C-3.4 Gather, expand, and apply mathematical knowledge to solve non-standard problems, including problems in a new, unfamiliar environment or interdisciplinary context
Gen.Pro.C-4 Combine and adapt current information and communications technologies (ICTs) to meet professional challenges	Gen.Pro.C-4.2 Apply ICTs to solve the task in hand, to draw conclusions, and to evaluate the obtained results
	Gen.Pro.C-4.3 Create original algorithms and use software tools and modern smart technologies for professional problem-solving
	Gen.Pro.C-4.1 Use ICTs to search and analyze professional information, highlight, structure, format, and present it in the form of analytical reviews with sound conclusions and recommendations
Pro.C-1 Become part of a professional community and conduct local research under scientific guidance using methods specific to a particular professional setting	Pro.C-1.1 Apply principles of scientific work, methods of data collection and analysis, ways of argumentation; prepare scientific reviews, publications, abstracts, and bibliographies on research topics in Russian and English
	Pro.C-1.2 Understand the verification process of software models used to solve related scientific problems
	Pro.C-1.3 Use practical knowledge of scientific argumentation when analyzing a research subject area

Pro.C-2 Understands and is able to apply modern mathematical apparatus and algorithms, the basic laws of natural science, modern programming languages and software; operating systems and networking technologies in research and applied activities	Pro.C-2.1 Demonstrate expert knowledge of research basics in the field of ICTs, philosophy and methodology of science, scientific research methods, and apply skills to use them
	Pro.C-2.2 Demonstrate practical experience of applying methods and digital signal processing algorithms, using the Internet, abstracting, referencing, searching for bibliographic sources, and working with scientific sources
	Pro.C-2.3 Use fundamental knowledge in the field of information theory to carry out research tasks
Pro.C-3 Participate in scholarly discussions, make speeches and presentations (oral, written, and online) on scientific topics, present research materials, proofread, edit, reference scientific works	Pro.C-3.1 Learn the basics of scholarly discussion and the forms of verbal scientific communication
	Pro.C-3.2 Hold an appropriate discussion of ICTs and information systems, ask and answer questions related to a particular scientific subject
	Pro.C-3.3 Participate in student science conferences, hold discussions on IT topics in various formats (face-to-face, online, by correspondence)

3. List of the planned results of the course (training module)

As a result of studying the course the student should:

know:

- The main ideas used in the construction of mathematical models;
- basic information about the requirements for modern computational methods;
- modern applied problems and mathematical models used in them.

be able to:

- Understand the task;
- use their knowledge to solve fundamental and applied problems;
- evaluate the correctness of problem statements;
- strictly prove or disprove the statement;
- independently find algorithms for solving problems, including non-standard ones, and analyze them;
- independently see the consequences of the results obtained;
- accurately present mathematical knowledge in the field of study of the course in oral and written form
- accurately present mathematical knowledge in the field of study of the course in oral and written form.

master:

- The skills of analyzing a large amount of information and solving problems;
- skills of independent work and development of new disciplines.

4. Content of the course (training module), structured by topics (sections), indicating the number of allocated academic hours and types of training sessions

4.1. The sections of the course (training module) and the complexity of the types of training sessions

№	Topic (section) of the course	Types of training sessions, including independent work			
		Lectures	Seminars	Laboratory practical	Independent work
1	Presentation of laboratories, departments.		5		10
2	Principles and means of writing scientific papers. Principles of construction of scientific reports.		5		10
3	Principles and means of preparation of presentations. Rules for registration of master's theses.		5		10

AH in total		15		30
Exam preparation	0 AH.			
Total complexity	45 AH., credits in total 1			

4.2. Content of the course (training module), structured by topics (sections)

Semester: 1 (Fall)

1. Presentation of laboratories, departments.

Discussion of the results presented in the "fresh" scientific periodicals and at the latest scientific conferences.
Discussion of the current status of work on master's theses (degree of readiness, existing problems and approaches to their solution, adjustment of training plans).

2. Principles and means of writing scientific papers. Principles of construction of scientific reports.

Stylistics of written scientific language. Structure, volume, formulas, abstract, citations and references, bibliography.
Stylistics of oral scientific language. Formulation of the topic, introduction, main part, conclusion. Stages of report preparation

3. Principles and means of preparation of presentations. Rules for registration of master's theses.

Presentation types. Defense of the thesis. Defense of the thesis. Conference. Presentation at the seminar.
Title page, volume, appendices.

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

Classroom equipped with a computer and multimedia equipment (projector, sound system).

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

Main literature

Фонд литературы кафедры:
Презентация научных проектов на английском языке: Книга для преподавателя Ю.Б. Кузьменкова, Москва, Издательство Московского Университета, 2012. – 140 с., ISBN 978-5-211-05993-1.

Additional literature

Not provided.

7. List of web resources that are necessary for the course (training module) mastering

Not used

8. List of information technologies used for implementation of the educational process, including a list of software and information reference systems (if necessary)

Not required.

9. Guidelines for students to master the course

A student studying a discipline must, on the one hand, master the general conceptual apparatus, and on the other hand, must learn to apply theoretical knowledge in practice.

As a result of studying the discipline, the student must know the basic definitions, concepts, axioms, methods of proof.

Successful mastering of the course requires intense independent work of the student. The course program provides the minimum required time for a student to work on a topic. Independent work includes:

– reading and taking notes of the recommended literature;

- study of educational material (on educational and scientific literature), preparation of answers to questions intended for independent study, proof of individual statements, properties;

- preparation for a differentiated test.

Guidance and control over the independent work of the student is carried out in the form of individual consultations.

It is important to achieve an understanding of the material being studied, and not its mechanical memorization. If it is difficult to study certain topics, questions, you should seek advice from the lecturer.

SUPPLEMENT

Assessment funds for course (training module)

major:	Applied Mathematics and Informatics
specialization:	Contemporary Combinatorics/Современная комбинаторика “Pusk” Online and Supplementary Education Centre Phystech School of Applied Mathematics and Informatics
term:	1
qualification:	Master

Semester, form of interim assessment: 1 (fall) - Grading test

Author: E.G. Molchanov, candidate of physics and mathematical sciences, associate professor

1. Competencies formed during the process of studying the course

Code and the name of the competence	Competency indicators
Gen.Pro.C-1 Address current challenges in fundamental and applied mathematics	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 tasks
Gen.Pro.C-3 Develop mathematical models and conduct their analysis in the processes of professional problem-solving	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 science and technology fields
	Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations for applying the obtained solutions
	Gen.Pro.C-3.4 Gather, expand, and apply mathematical knowledge to solve non-standard problems, including problems in a new, unfamiliar environment or interdisciplinary context
Gen.Pro.C-4 Combine and adapt current information and communications technologies (ICTs) to meet professional challenges	Gen.Pro.C-4.2 Apply ICTs to solve the task in hand, to draw conclusions, and to evaluate the obtained results
	Gen.Pro.C-4.3 Create original algorithms and use software tools and modern smart technologies for professional problem-solving
	Gen.Pro.C-4.1 Use ICTs to search and analyze professional information, highlight, structure, format, and present it in the form of analytical reviews with sound conclusions and recommendations
Pro.C-1 Become part of a professional community and conduct local research under scientific guidance using methods specific to a particular professional setting	Pro.C-1.1 Apply principles of scientific work, methods of data collection and analysis, ways of argumentation; prepare scientific reviews, publications, abstracts, and bibliographies on research topics in Russian and English
	Pro.C-1.2 Understand the verification process of software models used to solve related scientific problems
	Pro.C-1.3 Use practical knowledge of scientific argumentation when analyzing a research subject area
Pro.C-2 Understands and is able to apply modern mathematical apparatus and algorithms, the basic laws of natural science, modern programming languages and software; operating systems and networking technologies in research and applied activities	Pro.C-2.1 Demonstrate expert knowledge of research basics in the field of ICTs, philosophy and methodology of science, scientific research methods, and apply skills to use them
	Pro.C-2.2 Demonstrate practical experience of applying methods and digital signal processing algorithms, using the Internet, abstracting, referencing, searching for bibliographic sources, and working with scientific sources
	Pro.C-2.3 Use fundamental knowledge in the field of information theory to carry out research tasks
Pro.C-3 Participate in scholarly discussions, make speeches and presentations (oral, written, and online) on scientific topics, present research materials, proofread, edit, reference scientific works	Pro.C-3.1 Learn the basics of scholarly discussion and the forms of verbal scientific communication
	Pro.C-3.2 Hold an appropriate discussion of ICTs and information systems, ask and answer questions related to a particular scientific subject
	Pro.C-3.3 Participate in student science conferences, hold discussions on IT topics in various formats (face-to-face, online, by correspondence)

2. Competency assessment indicators

As a result of studying the course the student should:

know:

- The main ideas used in the construction of mathematical models;
- basic information about the requirements for modern computational methods;
- modern applied problems and mathematical models used in them.

be able to:

- Understand the task;
- use their knowledge to solve fundamental and applied problems;
- evaluate the correctness of problem statements;
- strictly prove or disprove the statement;
- independently find algorithms for solving problems, including non-standard ones, and analyze them;
- independently see the consequences of the results obtained;
- accurately present mathematical knowledge in the field of study of the course in oral and written form
- accurately present mathematical knowledge in the field of study of the course in oral and written form.

master:

- The skills of analyzing a large amount of information and solving problems;
- skills of independent work and development of new disciplines.

3. List of typical control tasks used to evaluate knowledge and skills

In order to control the mastering of educational material by students, an oral survey is conducted at the beginning of the lesson on the topic of the last lecture or at the end of the lesson on the topic covered.

4. Evaluation criteria

1) Basic principles of writing a scientific article.
2) Basic principles for constructing a scientific report.
3) Basic principles for preparing a presentation.
4) Building answers to questions
5) Rules for registration of a master's thesis.
6) Rules for issuing a dissertation for the degree of Candidate of Sciences.

Preparation of an article and / or report at a conference and / or report at a scientific seminar.

10 Exhibited to a student who has shown comprehensive, systematized, in-depth knowledge of the curriculum of the discipline, showing interest in this subject area, demonstrating the ability to confidently and creatively apply them in practice in solving specific problems, free and correct justification of the decisions made.

9 Exhibited to a student who has shown a comprehensive, systematized, deep knowledge of the curriculum of the discipline and the ability to confidently apply them in practice in solving specific problems, free and correct justification of the decisions made.

8 Exhibited to a student who has shown a comprehensive, systematized, deep knowledge of the curriculum of the discipline and the ability to confidently apply them in practice in solving specific problems, the correct justification of the decisions made, with some shortcomings.

7 It is given to a student if he knows the material well, presents it competently and to the point, knows how to apply the acquired knowledge in practice, but does not adequately substantiate the results obtained.

6 It is given to a student if he knows the material well, presents it competently and to the point, knows how to apply the acquired knowledge in practice, but allows some inaccuracies in the answer or in solving problems.

5 It is given to a student if he basically knows the material, presents it competently and to the point, knows how to apply the acquired knowledge in practice, but allows a sufficiently large number of inaccuracies in the answer or in solving problems.

satisfactorily

4 Exhibited to a student who has shown a fragmented, disparate nature of knowledge, insufficiently correct formulations of basic concepts, violations of the logicalпоследовательности в изложении программного material, but at the same time he has mastered the main sections of the curriculum necessary for further education, and can apply the acquired knowledge according to the model in a standard situation.

3 Exhibited to a student who has shown a fragmented, disparate nature of knowledge, making mistakes in the formulation of basic concepts, violations of the logical.

2 Exhibited to a student who does not know most of the main content of the curriculum of the discipline, makes gross mistakes in the formulation of the basic principles and does not know how to use the knowledge gained in solving typical problems.

1 Exhibited to a student who does not know the main content of the curriculum of the discipline, makes gross mistakes in the formulation of the basic concepts of the discipline and generally does not have the skills to solve typical practical problems.

5. Methodological materials defining the procedures for the assessment of knowledge, skills, abilities and/or experience

A differentiated test is carried out based on the results of performances during the academic year, prepared articles and reports.