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

THE MAIN EDUCATIONAL PROGRAM
OF HIGHER EDUCATION

**Level of higher education
MASTER**

**Domain of study
01.04.02 APPLIED MATHEMATICS AND INFORMATICS**

**Orientation (specialty)
APPLIED DATA ANALYSIS IN SOCIAL STUDIES/ПРИКЛАДНОЙ
АНАЛИЗ ДАННЫХ В СОЦИАЛЬНЫХ НАУКАХ**

**Starting year of the educational program
2023 y.**

The main educational program of higher education in the field domain of study 01.04.02 Applied Mathematics and Informatics, orientation (specialty) Applied Data Analysis in Social Studies/Прикладной анализ данных в социальных науках, implemented at MIPT, is a set of basic characteristics of education (volume, content, planned results), organizational and pedagogical conditions, forms of certification, which is presented as a general characteristic of the educational program, curriculum, academic calendar schedule, work programs of disciplines (modules), training programs, evaluation and methodological materials. The main educational program of higher education has been created on the basis of the educational standard domain of study 01.04.02 Applied Mathematics and Informatics, independently developed and approved by MIPT.

1. General characteristics of the educational program

Qualifications awarded to graduate: master.

Form of education: full-time

Education period: 2 years.

The educational program consists of 120 credits and includes all types of student's classroom and independent work, training, time, allotted for quality control of the mastering of the educational program by the student.

The contact work of students with teachers consists of, at least, 1 252 hours.

Program implementation language: english.

Using a network form of educational program implementation: no.

Program goal:

The program is aimed at training highly qualified specialists in the field of artificial intelligence, the purpose of which is to provide comprehensive knowledge in the field of machine and deep learning, as well as the ability to correctly apply their methods. Graduates of the program will gain competencies in the field of distributed and cloud computing, will gain the ability to draw useful conclusions as a result of data analysis and present them in an informative form, and graduates will also gain the skill of creating stable and productive software, as well as reliable and stable data transmission lines, a general understanding of the current state and development trends in the field of AI. The program focuses on the practical experience of students to work on AI applications, on real cases from companies and examples from scientific projects, and an interactive educational process. The program includes e-courses, weekly webinars and consultations with a teacher, individual supervision of scientific work.

2. Characteristics of the professional activity of graduates:
Fields of professional activity and areas of professional activity,
in which graduates, who have mastered the master's program, can carry out professional activities:

06 Communications, information and communications technologies (in the field of engineering, development, modernization of computer hardware and information systems).

Graduates can carry out professional activities in other fields of professional activity and (or) areas of professional activity, provided that their level of education and acquired competencies meet the requirements of the employee's qualification.

Types of tasks of professional activity of graduates:
research.

Tasks of professional activity of graduates:
application of fundamental knowledge gained in the field of mathematical and (or) natural sciences to the creation of new computer models, technologies and algorithms;

design, analysis and application of new computer models in modern natural science, technology, economics and management;

organization of experiments and tests, analysis of their results;

preparation of scientific and technical reports, reviews, publications based on the results of research.

Objects of professional activity of graduates, mastered the program Master's:

automated information processing and control systems;

mathematical, algorithmic, informational, technical, linguistic, ergonomic, organizational and legal support of the above-listed systems and their applications in the areas of high technology production, management and business;

software for computer hardware and automated systems (programs, software packages and systems).

3. List of professional standard, corresponding to the professional activities of graduates:

06.003 Software architect;

06.028 System programmer.

Code and name of the professional standard	Generalized labor functions			Labor functions		
	code	name	level of qualification	name	code	level of qualification
06.003 Professional standard "Software architect"	H	Assessment of the possibility of creating an architectural project	6	Evaluation of the possibility of creating an architectural design of a software tool	H/01.6	6
				Defining software tool architecture goals	H/02.6	6
				Identification of key scenarios for software tool architecture	H/03.6	6
	I	Approval and control of methods and ways of interaction of a software tool with its environment	6	Technical study of possible options for the architecture of components, including a description of the options and a feasibility study for the selected option	I/02.6	6
	K	Modernization of the software tool and its environment	6	Development of software product upgrade plans	K/01.6	6
				Changing the environment of the software product	K/02.6	6
06.028 Professional standard "System programmer"	B	Development of database management systems	7	Development of database management system components	B/01.7	7
				Documentation of the developed database management system as a whole and its components	B/03.7	7
				Maintenance of the created database management system	B/04.7	7
	C	Development of operating systems	7	Development of operating system architecture	C/02.7	7
				Formation of requirements for operating system	C/01.7	7
				Control of architecture compliance in the process of writing an operating system	C/04.7	7

				Documentation of the operating system under development	C/06.7	7
				Maintenance of the created operating system	C/07.7	7
	D	Organization of system software development	7	Formation of a group of programmers for the development of system software	D/02.7	7
				Organization of the work of programmers in the system software development group	D/03.7	7
				Supervising the activities of the programmers working group for the development of system software	D/04.7	7
				Providing the customer with the results of system software development	D /05.7	7

4. Requirements for the results of mastering the educational program

As a result of mastering the main educational program, the graduate should form universal, general professional and professional competencies.

Universal competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator 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 a project through all stages of its life cycle	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 Able to organise and lead a team, developing a team strategy to achieve a goal	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 Use modern communication tools in the academic and professional field, including those in a foreign language	UC-4.1 Exchange business information in oral and written forms in Russian and at least one 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 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-6.1 Achieve personal growth and professional development, determine priorities and ways to improve performance UC-6.2 Evaluate performance results in correlation with the set objectives and applied methods

General professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement
Gen.Pro.C-1 Address current challenges in fundamental and applied mathematics	Gen.Pro.C-1.1 Apply fundamental scientific knowledge, new scientific principles, and research methods in applied mathematics and computer science 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-2 Iimprove upon and implement new mathematical methods in applied problem solving	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 applied mathematical 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
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-4.1 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 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-5 An understanding of current scientific and technical problems in the field of informatics and computer technology, and is able to formulate professional tasks in scientific language	Gen.Pro.C-5.1 An understanding of the current state of research within his/her professional thematic area Gen.Pro.C-5.2 Able to assess the relevance of research in informatics and computer technology and its practical relevance Gen.Pro.C-5.3 A good command of the professional terminology used in modern scientific and technical literature, and is able to present the results of scientific work orally and in writing as part of professional communication	
Gen.Pro.C-6 Capable of selecting and/or developing approaches to solving typical and new problems in informatics and computer technology, taking into account the characteristics and limitations of different solution methods	Gen.Pro.C-6.1 Able to analyse the problem, plan the solution, suggest and combine ways of solving it Gen.Pro.C-6.2 Capable of developing and upgrading software and hardware for information and automated systems Gen.Pro.C-6.3 Able to use research methods to solve new problems by applying knowledge from different fields of science (technology) Gen.Pro.C-6.4 Proficient in analytical and computational solution methods, and understands and takes into account in practice the limits of applicability of the solutions obtained Gen.Pro.C-6.5 Able to independently acquire, develop and apply mathematical, natural science, socio-economic and professional knowledge to solve non-standard problems, including in new or unfamiliar environments and in an interdisciplinary context	

Professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement	Basis (professional standarts, analysis of other requirements for graduates)
type of professional activity tasks: research		
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	System programmer
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	Software architect
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)	System programmer

5. Curriculum

The curriculum (Appendix 1) determines the list, labor input, sequence and distribution by periods of study of academic disciplines (modules), trainings, other types of educational activities, forms of intermediate and final certification of students. The labor input of the educational program is set in credit units.

The volume of compulsory part, excluding the volume of the state final attestation, is 58,33 persents percent of the total volume of the program.

The matrix of compliance of competencies with the disciplines of the curriculum is given in Appendix 2.

6. Academic calendar schedule

Academic calendar schedule (Appendix 3) shows the distribution of types of educational activities, periods of attestation of students and vacations by year of study (courses) and within each academic year. The academic calendar schedule of the educational program of higher education includes 92 3/6 weeks, of which there are 59 weeks of theoretical and practical training, 16 4/6 weeks of the credit-examination period, 1 3/6weeks of the state final certification and 15 2/6 weeks of holidays.

7. Work programs of disciplines (modules)

Work programs of disciplines (modules), including evaluation materials for ongoing monitoring of progress and intermediate certification, are presented in Appendix 4.

8. Practice programs

The educational program provides for the following trainings:

Personal Research Project/Научно-исследовательская работа: practical training.

Work programs of trainings, including assessment materials for ongoing monitoring of progress and intermediate certification are presented in Appendix 5.

9. Program of the state final certification

As part of the state final certification, the following are provided:

Performance of and Defence of Graduation Thesis/Выполнение и защита выпускной квалификационной работы.

The program of the state final certification (Appendix 6) includes requirements for final qualifying works (volume, structure, design, presentation), the procedure for their implementation, the procedure for defending the final qualifying work, criteria for evaluating the results.

10. Material and technical, educational and methodological support of the educational program

Work programs of disciplines (modules), trainings determine the material and technical, educational and methodological support of the educational program, including a list of licensed and freely distributed software, a list of electronic educational publications and (or) printed publications, electronic educational resources, a list and composition of modern professional databases and information reference systems.

Classrooms for conducting learning sessions provided for by the educational program feature equipment and technical teaching aids, the composition of which is determined in the work programs of disciplines (modules) and trainings.

Premises for independent work of students are equipped with computers with Internet connection and are provided with access to the electronic information and educational environment of MIPT.

The MIPT electronic information and educational environment provides access to:

- Electronic library system (hereinafter – ELS):

Golden Fund of Scientific Classics ELS

University Online Library;

Book on Lime of University's Book House publishing house;

Doe publishing house ELS;
Urait publishing house ELS;
IBooks.ru publishing house ELS;
Information system "National Electronic Library" (NEL);
LLC Publishing House Fizmatkniga;
Znanium ELS;
books.mipt.ru ELS;
Litsenziat ELS;
Knowledge Lab ELS;
- international scientific journals and electronic databases:
ELS Doe Database
SPIE journals;
The Cambridge Crystallographic Data Centre Database;
Elsevier database;
Web of Science database;
abstract and scientometric database (citation index) Scopus;
American Chemical Society journals;
American Institute of Physics journals;
Optical Society of America database;
The Royal Society of Chemistry journals;
Sage Publications journals;
Taylor & Francis Group journals;
WILEY journals;
American Physical Society journals;
Cambridge University Press publishing house journals;
Institute of Electrical and Electronics Engineers database;
Institute of Physics journals;
MathSciNet abstract database;
Oxford University Press journals;
American Association for the Advancement of Science — AAAS journal;
Springer Nature E-Books database;
Questel patents database;
Annual Reviews journals.

Material, technical and methodological support of the educational program is carried out on the material and technical base of the MIPT Department of Machine Learning and Digital Humanities. Leading scientists and industrial experts in the field of politics, economics, sociology, ecology and jurisprudence are involved in the implementation of the program.

11. Features of the educational program implementation for the disabled and persons with special needs

If there are persons with disabilities or persons with special needs among students, the educational program is adapted taking into account the special educational needs of such students.
When teaching according to an individual curriculum for people with disabilities, the period for mastering the educational program can be extended at their request by no more than one year compared to the period for obtaining education for the corresponding form of education.

12. Staff conditions for the implementation of the educational program

The implementation of the basic educational program is provided by managers and scientific and pedagogical workers who have a basic education corresponding to the profile of the discipline taught, and an academic degree or experience in the relevant professional field and are systematically engaged in scientific

and (or) scientific and methodological activities in accordance with the requirements of the MIPT standard 01.04.02 Applied Mathematics and Computer Science. The implementation of the educational program is provided by highly qualified scientific and pedagogical workers - both full–time employees of MIPT and leading scientists – employees of research institutes..

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) with an education corresponding to the profile of the discipline (module) being taught, in the total number of scientific and pedagogical staff implementing the Master's program is more than 70 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) who have an academic degree (including an academic degree awarded abroad and recognized in the Russian Federation) and (or) an academic title (including an academic title obtained abroad and recognized in the Russian Federation), in the total number of scientific and pedagogical staff implementing the Master's program, is more than 60 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) from the number of managers and employees whose activities are related to the orientation (specialty) of the ongoing Master's program (having work experience in this professional field for more than 3 years) in the total number of employees implementing the master's program is more than 5 persents.

The general management of the scientific content of the master's program is carried out by the Candidate of Physics and Mathematical Sciences, Matveev Mikhail Yurevich, who carries out independent research projects and participates in the implementation of such projects in the field of study, who has annual publications based on the results of this research activity in leading Russian and international peer-reviewed scientific journals and publications, as well as carrying out annual approbation of the results of this research activity at national and international conferences.

Matveev Mikhail Yurievich – Candidate of Physical and Mathematical Sciences, Head of the Competence Center "Internet of Things" MTS.

The head carries out publication activity in the areas corresponding to the subject of the educational program. In particular, he is the co-author of the following publications:

Direct determination of the lifetime of singlet oxygen in polymers with saturated and unsaturated bonds / M. Yu. Matveev, A. P. Darmanyan // Reports of the Academy of Sciences of the USSR.

Kinetics of decay of singlet oxygen luminescence in polymers. Influence of the polymer matrix on the process of quenching the triplet state of the sensitizer by molecular oxygen / M. Yu. Matveev, AP Darmanyan // Khim. Physics - 1986. - V. 5, No. 11. - S. 1488-1495.

Direct determination of the lifetime of singlet oxygen by measuring the decay of its luminescence after a laser flash in amorphous polymer films / M. Yu. Matveev, AP Darmanyan // Izvestiya akademii nauk SSSR. Chem. Series - 1987. - No. 7. - S. 1484.

Quenching of singlet oxygen by ionol and beta-carotene in various polymer matrices / M. Yu. Matveev, A. P. Darmanyan // Khim. Physics - 1987. - V. 6, No. 10. - S. 1393.

Oxidation of polyisoprene rubber with singlet oxygen / Matveev M. Yu. Macromolecular compounds, short communications. - 1990, volume 32, Series B, number 6, pp. 441-444

The Russian economy on new paths / Investments in Russian industry: priority areas printed / Institute of Business and Economics. - 2006 - No. 19 - p. 58

Educational and methodical work:

Organization of sales in the field of information technology, UMK printed State University - Higher School of Economics Faculty of Business Informatics 120

Other publications:

"Method for comparative evaluation of the resistance to oxidation of hydroquinone developers of the "lit" type", printed Copyright certificate No. 1578689, registered on 03/09/1982 Uvarova R.M., Shashlov B.A., Shorina O.S., Shchegolev I.V.

"Explosive charge and method of its manufacture" Author's certificate No. 942496, registered on 03/09/1982 Pisarev Yu.A., Mirgorodsky V.N.

"Method of short-delayed blasting of rocks" Author's certificate No. 951928, registered on 14.04.1982

Pisarev Yu.A., Blozhe V.L., Vorobyov V.D.
"Method of crushing rocks". Copyright certificate No. 1052021, registered on 06/01/1983 Vorobyov V.D., Pisarev Yu.A., Gonchar I.F.
"Method of explosive crushing of rocks". Author's certificate No. 951927, registered on April 14, 1982 Pisarev Yu.A., Dauetas A.A., Vorobyov V.D., Gonchar I.F.

13. Information about the departments involved in the implementation of the educational program

Chair of Machine Learning and Digital Humanities : laboratory Manager, Doctor of Physics and Mathematical Sciences, Vorontsov Konstantin Vyacheslavovich, leading researcher-Head of the laboratory. The program is designed to obtain theoretical and applied knowledge in the field of artificial intelligence, necessary for solving professional problems. Classes will be taught by both MIPT instructors and specialists from partner studios. Program partners: Gaijin, Universal University, CrazyPanda, Vintersaga and others. Among the disciplines are the development of game engines, game design, graphics and animation programming, game production, advanced mathematics and many others.The Master's program in Game Programming Technologies will be launched with the support of game developer and publisher Gaijin, which combines expertise, internship opportunities for students at major game development companies, and free places. The program is focused on training programmers to create client games: students will immerse themselves in all aspects of developing and implementing portfolio implementation in the learning process. The Master's program "Modern Game Design" will be implemented with the support of the educational partner Scream School for those who want to learn how to design games and become a generalist in game design.People with any bachelor's degree without specialized training and with a portfolio of game projects (desirable) can study this direction. Students will learn how to design game mechanics and interfaces, get acquainted with the gaming industry, master data analysis and the basics of psychology in games. Training is carried out only on a contract basis.