Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia named after Patrice Lumumba"

Academy of Engineering
(name of the main educational unit (MEU) that developed the educational program of higher education)

WORKING PROGRAM OF THE DISCIPLINE

EQUATIONS OF MATHEMATICAL PHYSICS
(name of discipline/module)

Recommended for the field of study/specialty:

27.03.04 CONTROL IN TECHNICAL SYSTEMS
(code and name of the training area/specialty)

The discipline is mastered within the framework of the implementation of the main professional educational program of higher education (EP HE):

DATA SCIENCE AND SPACE SYSTEMS
(name (profile/specialization) of the educational institution of higher education)

2025

1. THE GOAL OF MASTERING THE DISCIPLINE

The discipline "Equations of Mathematical Physics" is included in the bachelor's program "Data Science and Space Systems" in the direction 27.03.04 "Control in Technical Systems" and is studied in the 7th semester of the 4th year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 2 sections and 17 topics and is aimed at studying the equations of mathematical physics and methods for solving them

The purpose of mastering the discipline is to acquire knowledge and skills in the theory of differential equations with partial derivatives of the second order arising in mathematical physics, mastering the methods of solving such equations, including analytical methods and numerical methods.

2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Equations of Mathematical Physics" is aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies developed in students while mastering the discipline (results of mastering the discipline)

Cipher	Competence	**Indicators of Competence Achievement** (within the framework of this discipline)
GPC-2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and natural science disciplines (modules)	GPC-2.1 Has mastered mathematical methods, programming fundamentals and specialized programming systems for implementing algorithms for solving applied problems; GPC-2.2 Able to select and adapt mathematical methods and software to solve practical problems; GPC-2.3 Possesses skills in developing and implementing algorithms for solving applied problems in the field of professional activity;
GPC-3	Able to use fundamental knowledge to solve basic control problems in technical systems in order to improve in professional activities	GPC-3.1 Knows the theoretical foundations and principles of mathematical modeling; GPC-3.2 Able to develop and use methods of mathematical modeling, information technologies to solve problems of applied mathematics; GPC-3.3 Possesses practical skills in solving problems of applied mathematics, methods of mathematical modeling, information technologies and the basics of their use in professional activities, skills of professional thinking and an arsenal of methods and approaches necessary for the adequate use of methods of modern mathematics in theoretical and applied problems;

3. PLACE OF THE DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL EDUCATIONAL EDUCATION

Discipline "Equations of Mathematical Physics" refers to the mandatory part of block 1 “Disciplines (modules)” of the educational program of higher education.

As part of the higher education program, students also master other disciplines and/or practices that contribute to the achievement of the planned results of mastering the discipline "Equations of Mathematical Physics".

Table 3.1. List of components of the educational program of higher education that contribute to the achievement of the planned results of mastering the discipline

Cipher	Name of competence	Previous courses/modules, practices*	Subsequent disciplines/modules, practices*
GPC-2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and natural science disciplines (modules)	Research work / Scientific research work; Technological Training; Mathematical analysis; Space Flight Mechanics; Numerical Methods; Automatic Control Theory; Algebra and Geometry; Analysis of Geoinformation Data;	Technological Training; Undergraduate Training;
GPC-3	Able to use fundamental knowledge to solve basic control problems in technical systems in order to improve in professional activities	Mathematical analysis; Space Flight Mechanics; Theoretical Mechanics; Numerical Methods; Automatic Control Theory; Algebra and Geometry; Theory of Probability and Mathematical Statistics; Differential equations; Complex analysis; Optimal Control Methods; Analysis of Geoinformation Data; Research work / Scientific research work; Technological Training;	Technological Training; Undergraduate Training;

* - filled in in accordance with the competency matrix and the SUP EP HE

** - elective disciplines/practices

4. SCOPE OF THE DISCIPLINE AND TYPES OF STUDY WORK

The total workload of the discipline "Equations of Mathematical Physics" is "8" credit units.

Table 4.1. Types of educational work by periods of mastering the educational program of higher education for full-time education.

Type of academic work	**TOTAL,**ac.h.		**Semester(s)**
			7
Contact work, academic hours	*108*		*108*
Lectures (LC)	54		54
Laboratory work (LW)	0		0
Practical/seminar classes (SC)	54		54
Independent work of students, academic hours	*153*		*153*
Control (exam/test with assessment), academic hours	*27*		*27*
General complexity of the discipline	**ac.h.**	***288***	*288*
	credit.ed.	***8***	*8*

5. CONTENT OF THE DISCIPLINE

Table 5.1. Contents of the discipline (module) by types of academic work

Section number	Name of the discipline section	Section Contents (Topics)		Type of academic work*
Section 1	Equations of Mathematical Physics	1.1	Basic equations of mathematical physics	LC, SC
		1.2	Cauchy problem for the equation of string vibrations	LC, SC
		1.3	d'Alembert's formula	LC, SC
		1.4	Vibrations of a semi-bounded string	LC, SC
		1.5	Fourier series	LC, SC
		1.6	Solution of the Cauchy problem for the equation of vibrations of a string with fixed ends	LC, SC
		1.7	Forced vibrations of a string	LC, SC
		1.8	Equation of heat propagation in a rod	LC, SC
		1.9	Thermal conductivity in a finite rod	LC, SC
		1.10	Laplace equation	LC, SC
		1.11	Writing in polar coordinates	LC, SC
		1.12	Fourier method for Laplace equation	LC, SC
Section 2	Methods for solving equations of mathematical physics	2.1	Methods of potential theory	LC, SC
		2.2	Numerical methods	LC, SC
		2.3	Variational methods	LC, SC
		2.4	Projection methods	LC, SC
		2.5	Asymptotic methods	LC, SC

* - filled in only for FULL-TIME education: LC – lectures; LW – laboratory work; SC – practical/seminar classes.

6. LOGISTIC AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support of the discipline

Audience type	Equipping the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means for multimedia presentations.	
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with a set of specialized furniture and technical means for multimedia presentations.	
For independent work	A classroom for independent work of students (can be used for conducting seminars and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information System.	

* - the audience for independent work of students MUST be indicated!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

Main literature:

1. Tikhonov A.N. Samarsky A.A. Equations of Mathematical Physics
2. Aramanovich I.G., Levin V.I. Equations of mathematical physics. M. Nauka.1976.
3. Savin A.Yu. Sternin B.Yu. Equations of mathematical physics.Presentation. RUDN. 2012
4. Kirillov A.I. (ed.) - Solution book. Higher Mathematics. Special sections, 2nd ed., FML, 2006
5. Korshunov Yu.S., Rynovskaya M.V., Savin A.Yu. Equations of mathematical physics.M. RUDN. 2016.

Further reading:

1. FarlowC.. Partial differential equations for scientists and engineers. M.Mir. 1985
2. E. Zauderer Partial differential equations and applied mathematics. 2006
3. Agoshkov V. I., Dubovsky P. B., Shutyaev V. P. Methods for solving problems of mathematical physics / Ed.G. I. Marchuk. - M.: FIZMATLIT, 2002. - 320 p. - ISBN 5-9221-02457-5

Resources of the information and telecommunications network "Internet":

1. RUDN University EBS and third-party EBSs to which university students have access on the basis of concluded agreements
   - Electronic library system of RUDN - ELS RUDNhttp://lib.rudn.ru/MegaPro/Web
   - Electronic library system "University library online"http://www.biblioclub.ru
   - EBS Yuraithttp://www.biblio-online.ru
   - Electronic Library System "Student Consultant" www.studentlibrary.ru
   - Electronic library system "Troitsky Bridge"
2. Databases and search engines
   - electronic fund of legal and normative-technical documentationhttp://docs.cntd.ru/
   - Yandex search enginehttps://www.yandex.ru/
   - search engineGoogle https://www.google.ru/
   - abstract databaseSCOPUS http://www.elsevierscience.ru/products/scopus/

Educational and methodological materials for independent work of students in mastering a discipline/module:*

1. Lecture course on the subject "Equations of Mathematical Physics".

* - all educational and methodological materials for independent work of students are posted in accordance with the current procedure on the discipline page in TUIS!

DEVELOPER:

Associate Professor		Demidov Alexander Sergeevich
Position, Department	*Signature*	*Surname I.O.*

HEAD OF THE DEPARTMENT:

Head of Department		Razumny Yuri Nikolaevich
Position of the Department	*Signature*	*Surname I.O.*

HEAD OF THE EP HE:

Head of Department		Razumny Yuri Nikolaevich
Position, Department	*Signature*	*Surname I.O.*