

Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Ястребов Олег Александрович
Должность: Ректор
Дата подписания: 28.06.2024 17:40:08
Уникальный программный ключ:
ca953a0120d891083f939673078ef1a989dae18a

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

Academy of Engineering

(name of the main educational unit (POU) - developer of the EP HE)

COURSE SYLLABUS

DIFFERENTIAL EQUATIONS

(name of discipline/module)

Recommended by the Didactic Council for the Education Field of:

27.03.04 CONTROL IN TECHNICAL SYSTEMS

(code and name of the area of training/specialty)

The course instruction is implemented within the professional education programme of higher education:

DATA ENGINEERING AND SPACE SYSTEMS CONTROL

(name (profile/specialization) EP HE)

1. GOAL OF DISCIPLINE MASTERING

The discipline “Differential equations” is included in the bachelor’s program “Data Engineering and Space Systems Control” in the direction of 27.03.04 “Control in Technical Systems” and is studied in the 3rd semester of the 2nd year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 8 sections and 11 topics and is aimed at studying the basis of the theory of differential equations, the basic methods of analytical, approximate analytical and numerical integration of differential equations and systems of differential equations, the basic methods of analyzing the stability of solutions, examples of the application of the theory and methods for solving differential equations in various applied problems.

The purpose of mastering the discipline is for students to study the theory of differential equations and master methods for solving them, increasing the general level of students’ mathematical culture.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline “Differential Equations” is aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies formed in students when mastering the discipline (results of mastering the discipline)

Cipher	Competence	Indicators of Competency Achievement (within this discipline)
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, professional thinking skills and an arsenal of methods and approaches necessary for the adequate use of methods of modern mathematics in theoretical and applied problems;
GPC -4	Able to evaluate the effectiveness of control systems developed based on mathematical methods	GPC-4.1 Knows the basic information security requirements, existing information and communication technologies; GPC-4.2 Able to solve problems of professional activity using information and communication technologies and taking into account the basic requirements of information security; GPC-4.3 Has the skills to use existing information technologies to solve professional problems;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

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

As part of the educational program of higher education, students also master other disciplines and/or practices that contribute to achieving the planned results of mastering the discipline “Differential Equations”.

Table 3.1. List of components of EP HE that contribute to achieving the planned results of mastering the discipline

Cipher	Name of competency	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
GPC -3	Able to use fundamental knowledge to solve basic control problems in technical systems in order to improve in professional activities	Mathematical analysis; Algebra and Geometry;	Research work / Scientific research work; Technological Training; Undergraduate practice / Pre-graduate practice; Space Flight Mechanics; Theoretical Mechanics; Numerical Methods; Automatic Control Theory; Theory of Probability and Mathematical Statistics; complex analysis; Equations of mathematical physics; Optimal Control Methods; Analysis of Geoinformation Data;
GPC -4	Able to evaluate the effectiveness of control systems developed based on mathematical methods		Analysis of Geoinformation Data; Research work / Scientific research work; Technological Training; Undergraduate practice / Pre-graduate practice;

* - to be filled out in accordance with the competency matrix and SUP EP VO

** - elective disciplines/practices

4. SCOPE OF DISCIPLINE AND TYPES OF STUDY WORK

The total labor intensity of the “Differential equations” discipline is “7” credit units.

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

Type of educational work	TOTAL,ac.ch.		Semester(s)
			3
<i>Contact work, ac.ch.</i>	72		72
Lectures (LC)	36		36
Laboratory work (LR)	0		0
Practical/seminar sessions (SZ)	36		36
<i>Independent work of students, ac.ch.</i>	153		153
<i>Control (exam/test with assessment), academic degree.</i>	27		27
Total labor intensity of the discipline	ac.ch.	252	252
	credit units	7	7

5. CONTENT OF DISCIPLINE

Table 5.1. Contents of the discipline (moDulya) by type of educational work

Section number	Name of the discipline section	Contents of the section (topic)		Type of educational work*
Section 1	First order differential equations	1.1	Integration of differential equations with separable variables and differential equations. Integration of homogeneous differential equations.	LC, NW
		1.2	Linear differential equations of the 1st order. Integration of linear remote controls.	LC, NW
		1.3	Equations not resolved with respect to the derivative. General method for entering a parameter. Lagrange and Clairaut equations.	LC, NW
Section 2	Higher order equations and systems of equations	2.1	Integrable cases of high-order equations (equations that can be reduced in order).	LC, NW
		2.2	Solving systems of differential equations by reducing them to higher order equations	LC, NW
Section 3	Existence and uniqueness theorems	3.1	Lipschitz condition. Theorem for the existence and uniqueness of a solution to the Cauchy problem in a bounded domain and in a strip	LC, NW
Section 4	Approximate analytical and numerical methods for solving the Cauchy problem	4.1	Method of successive approximations. Power series method. Small parameter method. Numerical methods	LC, NW
Section 5	Boundary value problems.	5.1	Green's function method. Approximate analytical methods for integrating boundary value problems.	LC, NW
Section 6	Elements of qualitative theory of differential equations.	6.1	Singular points of linear autonomous dynamic systems of the 2nd order. Phase plane method.	LC, NW
Section 7	Stability of solutions of linear equations and systems.	7.1	The concept of stability of solutions. Theorem of Lyapunov and Chetaev.	LC, NW
Section 8	First order partial differential equations	8.1	Nonlinear systems. First order partial differential equations.	LC, NW

* - to be filled out only for full-time education: LC – lectures; LR – laboratory work; SZ – practical/seminar classes.

6. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support of the discipline

Audience type	Auditorium equipment	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; board (screen) and technical means of multimedia presentations.	
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification, equipped with a set of	

Audience type	Auditorium equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
	specialized furniture and technical means for multimedia presentations.	
For independent work	An auditorium for independent work by students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to EIOS.	

* - the audience for independent work of students is MANDATORY!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF DISCIPLINE

Main literature:

1. Filippov A.F. Introduction to the theory of differential equations. - M.: Lenland, 2013
2. Filippov A.F. Collection of problems on differential equations. - M.: Librocom, 2012.
3. Krasnov M.L., Kiselev A.I., Makarenko G.I. Collection of problems on ordinary differential equations. — M.: Librocom, 2013

Additional literature:

1. Fedoryuk M.V. Ordinary differential equations. - M.: Librocom, 2012.
2. Elsgolts L.E. Differential equations. - M.: Publishing house LKI, 2013.
3. Stepanov V.V. Course of differential equations. - M.: Publishing house LKI, 2008.

Resources of the information and telecommunications network "Internet":

1. EBS of RUDN University and third-party EBS, to which university students have access based on concluded agreements

- Electronic library system of RUDN University - EBS RUDN University <http://lib.rudn.ru/MegaPro/Web>
- EBS "University Library Online" <http://www.biblioclub.ru>
- EBS Law <http://www.biblio-online.ru>
- EBS "Student Consultant" www.studentlibrary.ru
- EBS "Trinity Bridge"

2. Databases and search engines

- electronic fund of legal and regulatory technical documentation <http://docs.cntd.ru/>

- Yandex search engine <https://www.yandex.ru/>
- search system Google <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>

Educational and methodological materials for students' independent work when mastering a discipline/module:*

1. A course of lectures on the discipline "Differential equations".

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

8. ASSESSMENT MATERIALS AND POINT-RATING SYSTEM FOR ASSESSING THE LEVEL OF COMPETENCIES FOR A DISCIPLINE

Evaluation materials and point-rating system* for assessing the level of development of competencies (parts of competencies) based on the results of mastering the discipline “Differential equations” are presented in the Appendix to this Work Program of the discipline.

* - OM and BRS are formed on the basis of the requirements of the relevant local regulatory act of RUDN University.

DEVELOPERS:

Assistant professor

Position

Signature

Saltykova Olga
Alexandrovna

Last name I.O.

Assistant professor

Position

Signature

Usovik Igor
Vyacheslavovich

Last name I.O.

HEAD OF DEPARTMENT:

Head of the department

Position

Signature

Razumny Yuri Nikolaevich

Last name I.O.

HEAD OF EP HE:

Professor

Position

Signature

Razumny Yuri Nikolaevich

Last name I.O.