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

THEORETICAL MECHANICS
(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)

2024

1. GOAL OF DISCIPLINE MASTERING

The discipline “Theoretical Mechanics” 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 and 4th semesters of the 2nd year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 4 sections and 19 topics and is aimed at studying the fundamentals of theoretical mechanics, kinematics of a point and a rigid body, statics, dynamics of a point and a rigid body, and analytical mechanics. Particular attention is paid to the analysis of methods for solving typical problems and analysis of the scope of their application in professional activities.

The purpose of mastering the discipline is to increase the level of engineering literacy, the formation of fundamental knowledge and skills in applying methods for solving mechanical problems, necessary for professional activities and the development of subsequent disciplines.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline “Theoretical Mechanics” 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 -5	Able to solve problems of development of science, technology and technology in the field of management in technical systems, taking into account legal regulation in the field of intellectual property	GPC-5.1 Knows the theoretical foundations of digital technologies, the basics of modeling objects of professional activity, the basics of data analysis and information presentation; GPC-5.2 Able to solve problems of professional activity using existing methods of modeling, data analysis, and presentation of information; GPC -5.3 Has the skills to develop algorithms and computer programs suitable for practical use;
PC-4	Able to formulate, analyze and solve engineering problems in the field of ballistics, propulsion mechanics and spacecraft motion control based on professional knowledge	PC-4.1 Knows the basic concepts and basic algorithms for solving problems in the field of ballistics, motion mechanics and motion control based on automated and automatic systems; PC-4.2 Able to solve engineering problems of an analytical nature in the field of ballistics, motion mechanics and motion control of spacecraft based on professional knowledge; PC-4.3 Possesses the skills of using mathematical methods for processing information obtained as a result of experimental research, basic methods of analyzing the mechanics of motion and controlling the motion of spacecraft based on standard methods and software packages;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

Discipline "Theoretical mechanics" 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 “Theoretical Mechanics”.

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; Numerical Methods; Automatic Control Theory; Equations of mathematical physics; Optimal Control Methods; Analysis of Geoinformation Data;
GPC -5	Able to solve problems of development of science, technology and technology in the field of management in technical systems, taking into account legal regulation in the field of intellectual property		Research work / Scientific research work; Technological Training; Undergraduate practice / Pre-graduate practice; Automatic Control Theory; Analysis of Geoinformation Data;
PC-4	Able to formulate, analyze and solve engineering problems in the field of ballistics, propulsion mechanics and spacecraft motion control based on professional knowledge		Research work / Scientific research work; Technological Training; Undergraduate practice / Pre-graduate practice; Space Flight Mechanics; Optimal Control Methods;

* - 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 "Theoretical Mechanics" discipline is "8" 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	**4**
Contact work, ac.ch.	*140*		*72*	*68*
Lectures (LK)	70		36	34
Laboratory work (LR)	0		0	0
Practical/seminar sessions (SZ)	70		36	34
Independent work of students, ac.ch.	*94*		*81*	*13*
Control (exam/test with assessment), academic degree.	*54*		*27*	*27*
Total labor intensity of the discipline	**ac.ch.**	***288***	*180*	*108*
	credit units	***8***	*5*	*3*

5. CONTENT OF DISCIPLINE

*Table*Itza 5.1. Contents of the discipline (module) by type of academic work

Section number	Name of the discipline section	Contents of the section (topic)		Type of educational work*
Section 1	Introduction	1.1	Theoretical mechanics in the structure of scientific and technical knowledge. Areas of application of theoretical mechanics methods	OK
		1.2	Vector theory. Projections and coordinates of vectors. Operations on vectors in coordinate representation. Differentiation of a vector function by a scalar argument.	LC, NW
Section 2	Kinematics	2.1	Kinematics of a point	LC, NW
		2.2	The simplest motions of a rigid body	LC, NW
		2.3	Plane motion of a rigid body	LC, NW
		2.4	Rotation of a rigid body around a fixed axis	LC, NW
		2.5	General case of rigid body motion	LC, NW
		2.6	Complex point movement	LC, NW
		2.7	Complex rigid body motion	LC, NW
Section 3	Statics	3.1	Axioms and fundamental principles of statics	LC, NW
		3.2	Balance of bodies	LC, NW
		3.3	Friction	LC, NW
		3.4	Center of gravity	LC, NW
Section 4	Dynamics	4.1	Dynamics of a material point	LC, NW
		4.2	Geometry of masses	LC, NW
		4.3	General theorems of dynamics	LC, NW
		4.4	Rigid body dynamics	LC, NW
		4.5	D'Alembert's principle. Dynamic reactions of connections	LC, NW
		4.6	Fundamentals of Analytical Mechanics	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 specialized furniture and technical means for multimedia presentations.	
For independent work	An auditorium for independent work by students (can be used for seminars and	

Audience type	Auditorium equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
	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. Course of theoretical mechanics: Textbook for universities. 5th ed., rev. / Drong V.I., Dubinin V.V., Ilyin M.M. [etc.] ; ed. Kolesnikov K. S., Dubinin V. V. - M.: Publishing house of MSTU im.N. E. Bauman, 2017. 5th ed., revised. 580 pp. ISBN 978-5-7038-4568-4

2. Short course in theoretical mechanics. 20th ed., erased. / Targ S.M. - M.: Higher School, 2010. - 416 p.ISBN 978-5-06-006193-2

3. Meshchersky, I. V. Problems in theoretical mechanics: textbook / I. V. Meshchersky; edited by V. A. Palmov, D. R. Merkin. - 52nd ed., erased. — St. Petersburg: Lan, 2019. — 448 p. —ISBN 978-5-8114-4190-7. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/115729 (access date: 05/07/2023). — Access mode: for authorization. users.

4. Collection of short problems on theoretical mechanics: textbook / edited by O. E. Kepe. — 7th ed., erased. — St. Petersburg: Lan, 2020. — 368 p. —ISBN 978-5-8114-5266-8. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/138186 (access date: 05/07/2023). — Access mode: for authorization. users.

Additional literature:

1. Bat, M. I. Theoretical mechanics in examples and problems: textbook / M. I. Bat, G. Yu. Dzhanelidze, A. S. Kelzon. — 12th ed., erased. - St. Petersburg: Lan, [b. G.]. — Volume 1: Statics and kinematics — 2013. — 672 p. —ISBN 978-5-8114-1035-4. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/4551 (access date: 05/07/2023). — Access mode: for authorization. users.

2. Bat, M. I. Theoretical mechanics in examples and problems: textbook / M. I. Bat, G. Yu. Dzhanelidze, A. S. Kelzon. — 10th ed., erased. - St. Petersburg: Lan, [b. G.]. — Volume 2: Dynamics — 2013. — 640 p. —ISBN 978-5-8114-1021-7. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/4552 (access date: 05/07/2023). — Access mode: for authorization. users.

3. Dievsky, V. A. Theoretical mechanics: textbook / V. A. Dievsky. — 4th ed., rev. and additional - St. Petersburg: Lan, 2016. - 336 p. —ISBN 978-5-8114-0606-7. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/71745 (date of access: 05/07/2023). — Access mode: for authorization. users.

4. Babicheva, I. V. Theoretical mechanics. Examples and tasks for independent work: textbook / I. V. Babicheva, I. A. Abramova. — St. Petersburg: Lan, 2020. — 208 p. —ISBN 978-5-8114-4317-8. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/138154 (access date: 05/07/2023). — Access mode: for authorization. users.

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 Universityhttp://lib.rudn.ru/MegaPro/Web

- EBS “University Library Online”http://www.biblioclub.ru
- EBS Lawhttp://www.biblio-online.ru
- EBS “Student Consultant”www.studentlibrary.ru
- EBS “Trinity Bridge”
- EBS "Lan"

2. Databases and search engines

- electronic fund of legal and regulatory technical documentationhttp://docs.cntd.ru/
- Yandex search enginehttps://www.yandex.ru/
- search systemGoogle https://www.google.ru/
- abstract databaseSCOPUS 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 “Theoretical Mechanics”.

* - 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“Theoretical Mechanics” 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.

DEVELOPER:

Professor		Kupreev Sergey Alekseevich
Position	*Signature*	*Last name I.O.*

HEAD OF BUP:

Head of the department		Razumny Yuri Nikolaevich
Position	*Signature*	*Last name I.O.*

HEAD OF OP VO:

Professor		Razumny Yuri Nikolaevich
Position	*Signature*	*Last name I.O.*