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

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

DISCIPLINE WORK PROGRAM

AEROSPACE SYSTEMS
(name of discipline/module)

Recommended by MSSN for the following areas of training/specialty:

01.04.02 APPLIED MATHEMATICS AND INFORMATION SCIENCE
(code and name of the area of training/specialty)

The discipline is mastered as part of the implementation of the main professional educational program of higher education (OP HE):

BALLISTIC DESIGN OF SPACE COMPLEXES AND SYSTEMS
(name (profile/specialization) EP HE)

2024G.

1. GOAL OF DISCIPLINE MASTERING

The discipline "Aerospace Systems" is included in the master's program "Ballistic design of space complexes and systems" in the direction 01.04.02 "Applied mathematics and computer science" and is studied in the 2nd semester of the 1st year. The discipline is implemented by the Department of the Partner University. The discipline consists of 4 sections and 18 topics and is aimed at studying the fundamental principles of aeronautics, aerospace operations, human factors, safety management and systems thinking that enables them to solve real-world aerospace problems using the problem-solving process in Aerospace Systems. It establishes a basis for further education and employment in the fields of aviation management, flying streams, engineering and aerospace technical disciplines.

The purpose of mastering the discipline is to develop fundamental knowledge and skills in applying problem-solving methods necessary for professional activities, increasing the overall level of students' literacy in aerospace systems through their problem-solving learning experiences, improving their ability to interpret events, analyze situations and comprehend cause-and- effect relationships. Students recognize the complexity of global, national and local community problem situations and understand the challenges faced in generating sustainable and durable solutions.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Aerospace systems" 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)
UK-2	Able to manage a project at all stages of its life cycle	UK-2.1 Formulates a problem, the solution of which is directly related to achieving the project goal;; UK-2.2 Determines the connections between the assigned tasks and the expected results of their solution;; UK-2.3 Within the framework of the assigned tasks, determines the available resources and limitations, current legal norms;; UK-2.4 Analyzes the project implementation schedule as a whole and selects the optimal way to solve the assigned tasks, based on current legal norms and available resources and limitations;; UK-2.5 Monitors the progress of the project, adjusts the schedule in accordance with the results of control.;
OPK-2	Able to improve and implement new mathematical methods for solving applied problems	GPC-2.1 Uses the results of applied mathematics to master and adapt new methods for solving problems in the field of professional interests;; OPK-2.2 Implements and improves new methods for solving applied problems in the field of professional activity;; OPK-2.3 Conducts qualitative and quantitative analysis of the resulting solution in order to construct the optimal option.;
OPK-3	Able to develop mathematical models and analyze them when solving problems in the field of professional activity	OPK-3.1 Develops mathematical models in the field of applied mathematics and computer science;; OPK-3.2 Analyzes mathematical models for solving applied problems of professional activity;; GPC-3.3 Develops and analyzes new mathematical models for solving applied problems of professional activity in the field of applied mathematics and computer science.;
PK-3	Capable of participating in scientific research and development of design solutions in the field of ballistics,	PC-3.1 Knows basic mathematical methods and modern tools in the field of ballistic design of space complexes and systems;;

Cipher	Competence	Indicators of Competency Achievement (within this discipline)
	dynamics and spacecraft flight control	PC-3.2 Has basic knowledge of standards, norms and rules for the development of design solutions in the field of ballistics, dynamics and spacecraft flight control;; PC-3.3 Able to apply mathematical methods and modern information technologies when conducting scientific research and developing design solutions in the field of ballistics, dynamics and spacecraft flight control.;
PK-5	Able to analyze, including in English, methods for studying ballistic and dynamic characteristics when modeling spacecraft flight trajectories	PC-5.1 Knows proven and applied techniques, including from English-language sources, for studying ballistic and dynamic characteristics when modeling spacecraft flight trajectories;; PC-5.2 Able to develop and modernize methods for studying ballistic and dynamic characteristics when modeling spacecraft flight trajectories;; PC-5.3 Proficient in methods and approaches to the study of ballistic and dynamic characteristics when modeling spacecraft flight trajectories;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

Discipline "Aerospace systems" 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 “Aerospace Systems”.

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*
UK-2	Able to manage a project at all stages of its life cycle	*Applied Mechanics and Engineering***; *Systems Engineering***;	Practical Training in Receiving Remote Sensing Data from Satellites and its Interpretation (online from RUDN Mission Control Center) / Research; Pre-Graduation Internship in Industry; System Design; Dynamics and Control of Space Systems; Project "Drone Systems Engineering. Part 2";
OPK-2	Able to improve and implement new mathematical methods for solving applied problems	*Programming;*	System Design; On-board Energy; Dynamics and Control of Space Systems; Pre-Graduation Internship in Industry; Technological Training;
OPK-3	Able to develop mathematical models and analyze them when solving	*Programming;*	Pre-Graduation Internship in Industry; Technological Training; System Design;

Cipher	Name of competency	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
	problems in the field of professional activity		On-board Energy; Dynamics and Control of Space Systems; Project "Drone Systems Engineering. Part 2";
PK-3	Capable of participating in scientific research and development of design solutions in the field of ballistics, dynamics and spacecraft flight control	*Applied Mechanics and Engineering**; *Systems Engineering**;	Pre-Graduation Internship in Industry; Practical Training in Receiving Remote Sensing Data from Satellites and its Interpretation (online from RUDN Mission Control Center) / Research; Practical Training and Research in Dynamics and Control of Space Systems (online from RUDN Mission Control Center) / Research work; Technological Training; System Design; On-board Energy; Dynamics and Control of Space Systems; Project "Drone Systems Engineering. Part 2";
PK-5	Able to analyze, including in English, methods for studying ballistic and dynamic characteristics when modeling spacecraft flight trajectories	*English Language;* *Applied Mechanics and Engineering**; *Systems Engineering**; *Russian as a Foreign Language;*	Pre-Graduation Internship in Industry; Practical Training in Receiving Remote Sensing Data from Satellites and its Interpretation (online from RUDN Mission Control Center) / Research; Practical Training and Research in Dynamics and Control of Space Systems (online from RUDN Mission Control Center) / Research work; Technological Training; System Design; On-board Energy; Dynamics and Control of Space Systems;

* - 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 "Aerospace Systems" discipline is "5" 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)**
			2
Contact work, ac.ch.	*90*		*90*
Lectures (LK)	36		36
Laboratory work (LR)	18		18
Practical/seminar sessions (SZ)	36		36
Independent work of students, ac.ch.	*54*		*54*
Control (exam/test with assessment), academic degree.	*36*		*36*
Total labor intensity of the discipline	**ac.ch.**	***180***	*180*
	credit units	***5***	*5*

5. CONTENT OF DISCIPLINE

Table 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	Fundamentals of Flight	1.1	Aerodynamics and mechanics of flight	LC, LR, SZ
		1.2	Properties of the atmosphere	LC, LR, SZ
		1.3	Development of aerodynamic forces	LC, LR, SZ
		1.4	Basics of aircraft performance	LC, LR, SZ
		1.5	Stability and control	LC, LR, SZ
		1.6	Fundamentals of high speed flight	LC, LR, SZ
		1.7	Rotary wing flight	LC, LR, SZ
Section 2	Aircraft Electrical Systems	2.1	Operating principles and applications of the electrical systems	LC, LR, SZ
		2.2	Equipment used for the electric generation	LC, LR, SZ
		2.3	Distribution and utilization of electrical power required for aircraft operations	LC, LR, SZ
		2.4	Construction and operation of turbine engines	LC, LR, SZ
Section 3	Aerospace Operation and Practices	3.1	Industry practices in aircraft operation and maintenance	LC, LR, SZ
		3.2	Handling and usage of aircraft maintenance tools	LC, LR, SZ
		3.3	Quality management system, safety precaution requirements	LC, LR, SZ
		3.4	Interpretation of schematic diagrams for aircraft equipment installation	LC, LR, SZ
Section 4	Introduction to Operations Management	4.1	Operations strategy	LC, LR, SZ
		4.2	Design of operations processes	LC, LR, SZ
		4.3	Management of operations	LC, LR, SZ

* - 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	

Audience type	Auditorium equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
	furniture; board (screen) and technical means of multimedia presentations.	
Laboratory	An auditorium for conducting laboratory work, individual consultations, ongoing monitoring and intermediate certification, equipped with a set of specialized furniture and equipment.	
Computer class	A computer class for conducting classes, group and individual consultations, ongoing monitoring and intermediate certification, equipped with personal computers ([Parameter] pcs.), a whiteboard (screen) and technical means for 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 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. Orbital Mechanics for Engineering Students (Aerospace Engineering) 4th Edition—by Howard D. Curtis Ph.D. Purdue University

2. Introduction to Aerospace Engineering with a Flight Test Perspective (Aerospace Series) 1st Edition—by Stephen Corda

3. Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems 3rd Edition—by Brian L. Stevens, Frank L. Lewis, Eric N. Johnson

4. Missile Design and System Engineering (AIAA Education)—by Eugene L. Fleeman

Additional literature:

1. Rocket Propulsion Elements 9th Edition—by George P. Sutton, Oscar Biblarz

2. Aircraft Structures (Dover Books on Aeronautical Engineering)—by David J. Peery

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 - EBS RUDN http://lib.rudn.ru/MegaPro/Web
- EBS "University Library Online" http://www.biblioclub.ru
- EBS Yurayt 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/
- Google search engine https://www.google.ru/
- SCOPUS abstract database 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 “Aerospace systems”.

* - 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“Aerospace systems” 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.

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