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

Advanced Methods of Earth Remote Sensing

(name of discipline/module)

Recommended by didactic council for the education field of:

27.04.04 CONTROL IN TECHNICAL SYSTEMS

(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:

DATA SCIENCE AND SPACE ENGINEERING

(name (profile/specialization) EP HE)

2024

1. GOAL OF DISCIPLINE MASTERING

The discipline "Advanced Methods of Earth Remote Sensing" is included in the master's program "Data Science and Space Engineering" in the direction 27.04.04 "Control in Technical Systems" and is studied in the 2nd semester of the 1st year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 4 sections and 7 topics and is aimed at studying and acquiring practical skills in solving problems related to the acquisition, processing and application of Earth remote sensing data from space.

The purpose of mastering the discipline is to obtain knowledge, abilities, skills and experience in the field of remote sensing of the earth, characterizing the stages of developing competencies and ensuring the achievement of the planned results of mastering the educational program

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Advanced Methods of Earth Remote Sensing" 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-1	Able to analyze and identify the natural scientific essence of control problems in technical systems based on provisions, laws and methods in the field of natural sciences and mathematics	GPC-1.1 Knows the basic laws, regulations and methods in the field of natural sciences and mathematics;; GPC-1.2 Able to identify the natural scientific essence of control problems in technical systems, guided by the laws and methods of natural sciences and mathematics;; GPC-1.3 Possesses tools for analyzing management problems in technical systems.;
GPC-4	Able to evaluate the effectiveness of the results of developing control systems using mathematical methods	GPC-4.1 Knows the basic mathematical methods used to assess the effectiveness of the results of control systems;; GPC-4.2 Able to apply mathematical methods to assess the effectiveness of the results of control systems;; GPC-4.3 Knows methods for assessing the effectiveness of the results of management systems.;
GPC-6	Capable of collecting and analyzing scientific and technical information, summarizing domestic and foreign experience in the field of automation and control equipment	GPC-6.1 Knows the basic methods of collecting and analyzing scientific and technical information;; GPC-6.2 Able to analyze and generalize domestic and foreign experience in the field of automation and control equipment;; GPC-6.3 Knows methods of collecting and analyzing scientific and technical information, and can also generalize domestic and foreign experience in the professional industry.;
PK-3	Able to carry out work and research on processing and analysis of scientific and technical information obtained using geographic information systems and technologies	PC-3.1 Able to analyze the results of theoretical and experimental research;; PC-3.2 Can formulate recommendations for improving devices and systems, prepare scientific research results for publication and prepare documents for filing an application for an invention;; PC-3.3 Participates in the analysis of research results, has the skills to formulate recommendations for improving devices and systems, as well as writing articles and submitting documents for registration of inventions.;
PC-4	Capable of participating in scientific research and development of design solutions in the field of ballistics, dynamics and spacecraft flight control	PC-4.1 Familiar with the basic methods and approaches used to solve problems in the field of artificial intelligence and robotic systems;; PC-4.2 Knows methods for solving professional problems in the field of artificial intelligence and robotic systems;; PC-4.3 Able to apply mathematical methods and modern information technologies when conducting scientific research.;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

Discipline " Advanced Methods of Earth Remote Sensing " 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 "Advanced Methods of Earth Remote Sensing."

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-1	Able to analyze and identify the natural scientific essence of control problems in technical systems based on provisions, laws and methods in the field of natural sciences and mathematics	Virtual Reality and Computer Vision; Numerical Methods for Solving Mathematical Modeling Problems; Information Technology in Mathematical Modeling; Programming Technology;	Undergraduate practice / Pre-graduate practice; Geoinformation Systems and Applications;
GPC-4	Able to evaluate the effectiveness of the results of developing control systems using mathematical methods	History and Methodology of Science;	Dynamics and Control of Space Systems; Undergraduate practice / Pre-graduate practice;
GPC-6	Capable of collecting and analyzing scientific and technical information, summarizing domestic and foreign experience in the field of automation and control equipment	Machine Learning and Big Data Mining;	Undergraduate practice / Pre-graduate practice; Research work / Scientific research work;
PK-3	Able to carry out work and research on processing and analysis of scientific and technical information obtained using geographic information systems and technologies	Virtual Reality and Computer Vision;	Research work / Scientific research work; Undergraduate practice / Pre-graduate practice;
PC-4	Capable of participating in scientific research and development of design solutions in the field of ballistics, dynamics and spacecraft flight control	History and Methodology of Science;	Research work / Scientific research work; Undergraduate practice / Pre-graduate practice; Dynamics and Control of Space Systems; *Artificial Neural Networks (Reinforcement Learning)**;*

* - 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 "Advanced Methods of Earth Remote Sensing" discipline is "6" 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.	36		36
Lectures (LC)	18		18
Laboratory work (LR)	18		18
Practical/seminar sessions (SZ)	0		0
Independent work of students, ac.ch.	153		153
Control (exam/test with assessment), academic degree.	27		27
Total labor intensity of the discipline	**ac.ch.**	**216**	216
	credit units	**6**	6

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	Introduction.	1.1	Defining and reviewing the history of remote sensing and the evolution of remote sensing and the remote sensing system.	
		1.2	Electromagnetic radiation (EMR), terms and definitions, laws of radiation, EM spectrum, EMR sources.	
Section 2	Remote sensing systems	2.1	Active and passive systems, mapping and other systems, the concept of resolution in remote sensing - spatial, spectral, radiometric and temporal.	
		2.2	Orbits and platforms for Earth observation.	
Section 3	Image reception and processing	3.1	Reception, processing and creation of information products.	
		3.2	Mastering the freely distributed MultiSpec program for analyzing multispectral Landsat data (using the example of various objects and industries).	
Section 4	Applications	4.1	Applications of remote sensing in Earth, Ocean, atmospheric, emergency and climate change sciences.	

* - 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.	
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.	

Audience type	Auditorium equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
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. George Joseph: Fundamentals of Remote Sensing; Universities Press India Pvt Ltd, Hyderabad, India

2. Editors: John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, 2001. Manual of Geospatial Science and Technology, November 2001, Vol 1 Part 1and II.

Additional literature:

1. T. Takagi, T. Oguchi, J. Matsumoto, M. J. Grossman, M. H. Sarker, M. A. Matin (2007) Channel braiding and stability of the Brahmaputra River, Bangladesh, since 1967: GIS and remote sensing analyses, Geomorphology 85, 294– 305

2. John D. Bossler; John R. Jensen; Robert B. McMaster; Chris Rizos, (Editors), 2001. Photogrammetric and remote sensing considerations; Chapter 16, Manual of Geospatial Science and Technology, Vol 1 Part 4 Pages 233 – 252

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"

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 "Advanced Methods of Earth Remote Sensing."

* - 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"Advanced Methods of Earth Remote Sensing" 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:

Assistant professor		Dryga Danil Olegovich
Position	*Signature*	*Last name I.O.*

HEAD OF DEPARTMENT:

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