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

ANALYSIS OF GEOINFORMATION DATA
(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 "Analysis of Geoinformation Data" 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 4, 5, 6 semesters of 2, 3 courses. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 2 sections and 9 topics and is aimed at studying the formation and development of professional, methodological, information and communication competence in accordance with the requirements of the State Educational Standards of the new generation, the formation of special professional competencies related to the possibility of using innovative methods of information support for management processes when solving applied tasks, bringing the latest achievements of Russian science as close as possible to the needs of the educational process, mastering the methodology of project activities taking into account the use of digital educational resources, ensuring a new quality of education using the latest software that makes it possible to use the achievements of RKD, familiarization with international law governing issues of space activities and applications of space technology; with the general structure and main elements of the system of international space law, familiarization with the role of national governments and international organizations in regulating space activities and the use of space technology.

The goal of mastering the discipline is to form a new quality of education using the latest software that allows you to use the achievements of the results of space activities (RKD), the formation of special professional competencies associated with the possibility of using innovative management methods in solving problems of international relations. Develop knowledge about modern remote sensing technologies and their applications for thematic geographical studies at different scales. Acquiring practical skills in collecting, automated processing and thematic interpretation of remote sensing data of various types for geographical research.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline “Analysis of geoinformation data” 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)
GC-12	Able to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data received from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	GC -12.1 Searches for the necessary sources of information and data, perceives, analyzes, remembers and transmits information using digital means, as well as using algorithms when working with data received from various sources in order to effectively use the received information to solve problems; GC -12.2 Evaluates information, its reliability, builds logical conclusions based on incoming information and data;
GPC-2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and natural science disciplines (modules)	GPC -2.1 Proficient in 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 Has the skills to develop and implement algorithms for solving applied problems in the field of professional activity;

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;
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;
GPC -9	Able to perform experiments using given methods and process the results using modern information technologies and technical means	GPC -9.1 Knows modern information technologies and technical means; GPC -9.2 Able to use modern information technologies and technical means to process the results of experiments; GPC -9.3 Possesses modern information technologies and technical means for performing experiments and processing results;
PC-1	Capable of collecting, processing and interpreting modern scientific research data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	PC-1.1 Knows modern methods of how to collect, process and interpret modern scientific research data necessary to form conclusions on relevant scientific research; PC-1.2 Able to apply modern methods and tools for processing and interpreting scientific research data; PC-1.3 Possesses the basic skills of collecting, processing and interpreting modern scientific research data necessary to form conclusions on relevant scientific research;
PK-3	Capable of carrying out work on processing and analyzing information in the field of application of mathematical methods and information technologies in the field of application of Earth remote sensing data from space	PC-3.1 Knows the basic concepts in the field of application of mathematical methods and information technologies and the use of space remote sensing systems; PC-3.2 Able to solve problems of an analytical nature, offering a choice from a variety of current methods for solving problems, has skills in working with software packages of geographic information systems; PC-3.3 Possesses practical skills in solving problems related to obtaining, processing and using Earth remote sensing data from space;
PK-5	Able to develop, debug, test functionality, and modify software; apply software design methods and tools, develop and coordinate software documentation	PC-5.1 Knows existing system and application software, methods of design and development of software, structures and databases, software interfaces. Knows the regulatory and technical documentation for the development of software documentation; PC-5.2 Can apply methods and tools for designing software, data structures, databases, and software interfaces. Able to analyze regulatory and technical documentation to develop program documentation for software;

Cipher	Competence	Indicators of Competency Achievement (within this discipline)
		PC-5.3 Possesses basic skills in technologies for development, debugging, performance testing and modification of system application software, modernization of technical solutions for software development;

3. PLACE OF DISCIPLINE IN THE STRUCTURE OF HE EP

Discipline "Analysis of geoinformation data" 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 “Analysis of Geographic Information Data”.

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*
GC-12	Able to search for the necessary sources of information and data, perceive, analyze, remember and transmit information using digital means, as well as using algorithms when working with data received from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	*Fundamentals of information security and cyber resilience***; *Fundamentals of information security and cyber resilience***;	Technological Training; Undergraduate practice / Pre-graduate practice; Optimal Control Methods;
GPC -2	Able to formulate tasks of professional activity based on knowledge, specialized sections of mathematical and natural science disciplines (modules)	*Mathematical analysis; Space Flight Mechanics; Algebra and Geometry;*	Technological Training; Undergraduate practice / Pre-graduate practice; Equations of mathematical physics; Space Flight Mechanics;
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; Algebra and Geometry; Theory of Probability and Mathematical Statistics; Differential equations;*	Space Flight Mechanics; Equations of mathematical physics; Optimal Control Methods; Technological Training; Undergraduate practice / Pre-graduate practice;
GPC -4	Able to evaluate the effectiveness of control systems developed based on mathematical methods	*Differential equations;*	Technological Training; Undergraduate practice / Pre-graduate practice;
GPC -5	Able to solve problems of development of science, technology and technology	*Theoretical Mechanics;*	Technological Training; Undergraduate practice / Pre-graduate practice;

Cipher	Name of competency	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
	in the field of management in technical systems, taking into account legal regulation in the field of intellectual property		
GPC -9	Able to perform experiments using given methods and process the results using modern information technologies and technical means	*Computer Science and Programming;* *Basic Military Training. Life Safety;*	Undergraduate practice / Pre-graduate practice; Technological Training; Optimal Control Methods;
PC-1	Capable of collecting, processing and interpreting modern scientific research data necessary to draw conclusions on relevant scientific research, including Earth remote sensing data	*Computer Science and Programming;* *Discrete mathematics**;* *Discrete Math**;* *Space Flight Mechanics;*	Space Flight Mechanics; *Virtual and Augmented Reality Technology***; *Virtual and augmented reality technologies***; Optimal Control Methods; Technological Training; Undergraduate practice / Pre-graduate practice;
PK-3	Capable of carrying out work on processing and analyzing information in the field of application of mathematical methods and information technologies in the field of application of Earth remote sensing data from space		Technological Training; Undergraduate practice / Pre-graduate practice;
PK-5	Able to develop, debug, test functionality, and modify software; apply software design methods and tools, develop and coordinate software documentation	*Fundamentals of information security and cyber resilience**;* *Fundamentals of information security and cyber resilience**;*	Technological Training; Undergraduate practice / Pre-graduate practice; *Virtual and augmented reality technologies***; *Virtual and Augmented Reality Technology***;

* - 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 "Analysis of Geoinformation Data" discipline is "12" 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)**		
			4	**5**	**6**
Contact work, ac.ch.	*142*		*34*	*54*	*54*
Lectures (LC)	53		17	18	18
Laboratory work (LR)	89		17	36	36
Practical/seminar sessions (SZ)	0		0	0	0
Independent work of students, ac.ch.	*218*		*56*	*27*	*135*
Control (exam/test with assessment), academic degree.	*72*		*18*	*27*	*27*
Total labor intensity of the discipline	**ac.ch.**	***432***	*108*	*108*	*216*
	credit units	***12***	*3*	*3*	*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	Fundamental concepts of geoinformatics	1.1	Basic concepts and definitions: cartography, geoinformatics, GIS, remote sensing.	LK, LR
		1.2	Main tasks of geoinformatics	LK, LR
		1.3	Software and hardware of modern geographic information systems	LK, LR
Section 2	Spatial data	2.1	Review of various spatial data sources.	LK, LR
		2.2	Types and sources of spatial data	LK, LR
		2.3	Concept of vector and raster data. Basic data formats	LK, LR
		2.4	The concept of layered data organization	LK, LR
		2.5	Operations with raster and vector data	LK, LR
		2.6	Visualization of spatial data	LK, LR

* - 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.	
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. Schowengerdt Robert A. Remote sensing. Models and methods of image processing / Shovengerdt R.A.; Kiryushin A.V., Demyanikov A.I. (translated from English). — 3rd ed. - M.: Tekhnosphere, 2013. - 589 p.

2. Monograph “State and prospects for using the results of space activities in the interests of modernizing the economy of the Russian Federation and developing its regions” / Makarov Yu.N., Bezborodov V.G., Zhiganov A.N. and etc.; under the general editorship of V.G. Bezborodova. – Moscow: JSC “Research Institute “ENTSITEKH”, 2014. – 318 p.

3. Geoinformatics. // Kapralov E.G., Koshkarev A.V., Tikunov V.S., Lurie I.K., Serapinas B.B., Rylsky I.A.; edited by Tikunova V.S. – 3rd ed., revised. and additional – M. Academy, 2010.ISBN: 5-7695-6468-7 ISBN 978-5-7695-6468-0, 400 pp.

4. Rhys U.G. Fundamentals of remote sensing/U. Fig.-Moscow: Tekhnosphere, 2006,ISBN 5-94836-094-6.-336.

5. Tokareva O.S. Processing and interpretation of Earth remote sensing data. Tutorial. Publishing house of Tomsk Polytechnic University. Tomsk, 2010 -148 p.

6. Malin A.S. Regional management. Uch. State benefit University Higher School of Economics M.: ed. GUVSHE house, 2006

Additional literature:

1. Geoinformatics: in 2 books: textbook for students of higher educational institutions / Kapralov E.G., Koshkarev A.V., Tikunov V.S. and etc.; edited by Tikunova V.S. – 2nd ed., revised. and additional – M. Academy, 2008, 384 p.

2. Tikunov V.S., Kapralov E.G. Koshkarev A.V. and others. Fundamentals of geoinformatics. Textbook for universities.M. Academy. 2004, 2006

3. Geoinformation mapping. Methods of geoinformatics and digital processing of space images: textbook. // Lurie I.K. - 2nd edition, revised - M.: KDU, 2010.

4. Mirtova I.A., Topographical interpretation of objects of the Land and City Cadastre.Textbook - M.: Publishing House MIIGAiK, 2007 -120 p.

5. Directory of standard and commonly used (common) terms) on geodesy and cartography, topography, geographic information systems, spatial data // Aleksandrov V.N., Bazina M.A., Zhurkin I.G., Kornilova L.V., Pleshkov V.G., Pobedinsky G.G., Rebriy A.V., Timkina O.V. - M. Bratishka, 2007 -736 s

6. Zhurkin I.G., Shaitura S.V. Geographic information systems.Kudits-Press, 2009– 272 p.

7. Gruzinov V.S. System bases of geoinformation modeling of territories // Geodesy and cartography. - 2009. - No. 1 - p. 51-54

8. Gruzinov V.S. Knowledge system as an element of GIS information support // News of universities.Geodesy and aerial photography. - 2009. - No. 3 - p. 72-75

9. Gruzinov V.S. Prospects for the development of functional capabilities of GIS software // News of universities.Geodesy and aerial photography. - 2009. No. 6 - p.89-91

10. Gruzinov V.S. Geoportals and geonetworks as elements of geospatial data exchange infrastructure // News of higher educational institutions.Geodesy and aerial photography, No. 1, 2014 p. 95-100

11. Zhurkin I.G., Chaban L.N., Gruzinov V.S. Geoinformation modeling and mapping of natural resource potential.“Geodesy and Cartography”, No. 7, 2009 p. 34-39

12. Kravchenko Yu.A. Basics of designing geomodeling systems.Book 2 Information geomodeling. Models and methods. SSGA, Novosibirsk, 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 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”
- PC "Quantum GIS (QGIS)"; http://qgis.org/ru/site/

- PC "MapInfo"; http://www.esti-map.ru
- PC "AutoCAD Map3D" http://www.autodesk.ru/adsk/servlet/index?siteID=871736&id=12392051
- SAS. Planet; www.sasgis.ru
- PC "ScanEx Image Processor"; http://www.scanex.ru/ru/software/default.asp?submenu=imageprocessor&id=basicconfig
- JOSM; http://josm.ru/

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/
- Interregional public organization to promote the development of the market for geoinformation technologies and servicesWebsite of the GIS Association: http://www.gisa.ru
- Association of developers, manufacturers and consumers of equipment and applications based on global navigation satellite systems "GLONASS/GNSS–Forum":http://aggf.ru/
- Interindustry magazine of navigation technologies "GLONASS Bulletin":http://vestnik-glonass.ru/
- State and prospects of the Russian satellite navigation market 2010: analytical review. – M: 2011http://aggf.ru/analitika/AGGF_2011.pdf
- Introduction to geographic information systems /Website "GIS-Lab and authors" (http://gis-lab.info/docs/giscourse), Aug. 2007
- Basic GIS - RECODE platform.http://ssc.rekod.ru/content/services/3

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

1. A course of lectures on the discipline "Analysis of geoinformation data."

* - 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"Analysis of geographic information data" 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:

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HEAD OF BUP:

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