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

Academy of Engineering

(name of the main educational unit (MEU) that developed the educational program of higher education)

WORKING PROGRAM OF THE DISCIPLINE

INTRODUCTION TO GEOSPATIAL TECHNOLOGY

(name of discipline/module)

Recommended for the field of study/specialty:

27.04.04 CONTROL IN TECHNICAL SYSTEMS

(code and name of the training area/specialty)

The discipline is mastered within the framework of the implementation of the main professional educational program of higher education (EP HE):

**AIML and Space Sciences / Artificial Intelligence, Machine Learning and Space
Sciences**

(name (profile/specialization) of the educational institution of higher education)

1. THE GOAL OF MASTERING THE DISCIPLINE

The course "Introduction to Geospatial Technology" is part of the Master's program "Artificial Intelligence, Machine Learning and Space Sciences" in the direction 27.04.04 "Control in Technical Systems" and is studied in the 1st semester of the 1st year. The course is implemented by the Department of the Partner University. The course consists of 3 sections and 3 topics and is aimed at studying the principles of creation and operation of geoinformation systems, mastering the principles of spatial data analysis.

The purpose of mastering the discipline is to provide students with knowledge about geographic information systems and technologies, and to develop skills in spatial analysis of geodata.

2. REQUIREMENTS TO THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline " Introduction to Geospatial Technology " is aimed at developing the following competencies (parts of competencies) in students:

Table 2.1. List of competencies developed in students while mastering the discipline (results of mastering the discipline)

Cipher	Competence	Indicators of Competence Achievement (within the framework of 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-1.3 Has knowledge of tools for analyzing control problems in technical systems;
GPC-9	Capable of developing methods and performing experiments on existing facilities with processing of results based on information technologies and technical means	GPC-9.1 Possesses modern information technologies and technical means for conducting experiments at operating facilities; GPC-9.2 Has skills in developing methods and conducting experiments at existing facilities; GPC-9.3 Has the skills to develop methods and perform experiments at existing facilities with processing of results using information technology;
PC-3	Capable of carrying out work and research on the 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 Able to formulate recommendations for improving devices and systems, prepare scientific research results for publication and generate 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;

3. PLACE OF THE DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL EDUCATION

Course "Introduction to Geospatial Technology" refers to the mandatory part of block 1 "Disciplines (modules)" of the educational program of higher education.

As part of the higher education program, students also master other disciplines and/or practices that contribute to the achievement of the planned results of mastering the discipline "Introduction to Geospatial Technology".

Table 3.1. List of components of the educational program of higher education that contribute to the achievement of the planned results of mastering the discipline

Cipher	Name of competence	Previous courses/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		Undergraduate practice / Pre-graduation practice; Geoinformation Systems and Applications;
GPC-9	Capable of developing methods and performing experiments on existing facilities with processing of results based on information technologies and technical means		Undergraduate practice / Pre-graduation practice; Dynamics and Control of Space Systems; Geoinformation Systems and Applications; Advance Python Programming for Spatial Analytics; Operations Research and Optimization Techniques;
PC-3	Capable of carrying out work and research on the processing and analysis of scientific and technical information obtained using geographic information systems and technologies		Research work / Research work (acquiring primary skills in research work); Undergraduate practice / Pre-graduation practice; Advance Python Programming for Spatial Analytics;

* - filled in in accordance with the competency matrix and the SUP EP HE

** - elective disciplines/practices

4. SCOPE OF THE DISCIPLINE AND TYPES OF STUDY WORK

The total workload of the course “Introduction to Geospatial Technology” is 4 credits.

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

Type of academic work	TOTAL,ac.h.		Semester(s)
			1
<i>Contact work, academic hours</i>	34		34
Lectures (LC)	17		17
Laboratory work (LW)	17		17
Practical/seminar classes (SC)	0		0
<i>Independent work of students, academic hours</i>	83		83
<i>Control (exam/test with assessment), academic hours</i>	27		27
General complexity of the discipline	ac.h.	144	144
	credit.ed.	4	4

5. CONTENT OF THE DISCIPLINE

Table 5.1. Contents of the discipline (module) by types of academic work

Section number	Name of the discipline section	Section Contents (Topics)		Type of academic work*
Section 1	General information about geographic information systems	1.1	Concepts of the terms "information", "information system". Classification of information and information systems. Geographic information systems. Stages of GIS development. Relationship of GIS with other sciences. Aspects of GIS. Subject, functions, tasks and goals of GIS development. Components and structure of GIS. Classifications of GIS. Concept of an object and properties of an object. Spatial objects and their properties. Geospatial data and their structure. Organization of data in GIS.	LC, LW
Section 2	Data Models in GIS	2.1	Spatial data models. Raster data models. Raster data compression methods. Vector method of representing geographic space. Vector data models. Compression of vector data models. The concept of "database" and "data model". Classification of data models. Basic concepts of a relational database. Database management systems.	LC, LW
Section 3	GIS functionality	3.1	GIS functionality. Data entry functions. Data transformation functions. Projection transformation functions. Data model transformation functions. Database functions. Queries. Cartometric operations functions. Spatial analysis and modeling functions. Operations output and visualization of data. Non-standard data visualization methods. The concept of CAD, history of creation, structure, classification, examples of CAD.	LC, LW

* - filled in only for FULL-TIME education: LC – lectures; LW – laboratory work; SC – practical/seminar classes.

6. LOGISTIC AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Material and technical support of the discipline

Audience type	Equipping the auditorium	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; a board (screen) and technical means for multimedia presentations.	
Computer class	A computer room for conducting classes, group and individual consultations, ongoing monitoring and midterm assessment, equipped with personal computers (in the amount of [Parameter] pcs.), a board	

Audience type	Equipping the auditorium	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
	(screen) and technical means for multimedia presentations.	
For independent work	A classroom for independent work of students (can be used for conducting seminars and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information System.	

* - the audience for independent work of students MUST be indicated!

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

Main literature:

1. Abdalla R. Introduction to geospatial information and communication technology (GeoICT). – Cham, Switzerland: Springer International Publishing, 2016.
2. Haklay MM (ed.). Interacting with geospatial technologies. – John Wiley & Sons, 2010.

Further reading:

1. Ota M., Plews R. Development of a software tool as an introduction to Geospatial Information Technology based on geospatial standards //Cartography and Geographic Information Science. – 2015. – T. 42. – No. 5. – pp. 419-434.
2. Shit PK et al. (ed.). Geospatial Practices in Natural Resources Management. – Springer, 2024.

Resources of the information and telecommunications network "Internet":

1. RUDN University EBS and third-party EBSs to which university students have access on the basis of concluded agreements
 - Electronic library system of RUDN - ELS RUDN
<https://mega.rudn.ru/MegaPro/Web>
 - Electronic library system "University library online" <http://www.biblioclub.ru>
 - EBS Yurait <http://www.biblio-online.ru>
 - Electronic Library System "Student Consultant" www.studentlibrary.ru
 - EBS "Znaniy" <https://znaniy.ru/>
2. Databases and search engines
 - Sage <https://journals.sagepub.com/>
 - Springer Nature Link <https://link.springer.com/>
 - Wiley Journal Database <https://onlinelibrary.wiley.com/>
 - Scientometric database Lens.org <https://www.lens.org>

Educational and methodological materials for independent work of students in mastering a discipline/module:*

1. Lecture course on the subject "Introduction to geospatial technologies".

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

DEVELOPER:

Associate Professor		Saltykova Olga Alexandrovna
<i>Position, Department</i>	<i>Signature</i>	<i>Surname I.O.</i>

**HEAD OF THE
DEPARTMENT:**

<i>Position of the Department</i>	<i>Signature</i>	<i>Surname I.O.</i>

HEAD OF THE EP HE:

Head of Department		Razumny Yuri Nikolaevich
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