Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
(RUDN University)

Academy of Engineering
(name of the educational division - developer of the HEP HE)

COURSE SYLLABUS

Digital Technologies in Geology
(Subject / Course title)

Recommended by the Didactic Council for the Education Field of:

05.04.01 Geology
(code and name of the Higher Education Field)

The development of the discipline is carried out within the framework of the implementation of the Higher Education Programme of Higher Education (HEP HE):

Mining Geology
(name (profile/specialization) of the Higher Education Program)

2023

1. AIMS AND OBJECTIVES

The purpose of mastering the discipline "Digital Technologies in Geology" is:

- acquiring knowledge, skills and experience in the field of digital computer technology in solving various geological problems, characterizing the stages of competence formation and ensuring the achievement of the planned results of the educational programme.

The main objectives of the discipline are:

- acquaint students with the capabilities of modern computer programs for geological surveying, prospecting, exploration and development of mineral deposits, conducting research work;
- to teach students to master new software tools independently and in a minimum time, based on the general principles of building application software packages;
- to teach students to transform (formalize) geological data into formats suitable for machine processing.

2. REQUIREMENTS TO LEARNING OUTCOMES

Mastering the discipline "Digital Technologies in Geology" is aimed at developing the following competencies (parts of competencies) among students:

Table 2.1. The list of competencies formed by students in the course of mastering the discipline (the results of mastering the discipline)

Code	Competence	**Competence Formation Indicators** (within this discipline)
GC-1	Able to search, critical analysis of problem situations based on a systematic approach, develop an action strategy.	GC-1.1. Analyzes the problem, identifying its basic components;
		GC-1.2. Performs information retrieval for solving the task by various types of inquiries;
		GC-1.3. Suggests options for solving the problem, analyzes the possible consequences of their use.
GC-7	Capable: - search for the necessary sources of information and data, perceive, analyze, memorize 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-7.1 Searches for relevant sources of information and data, perceives, analyzes, remembers and communicates information using digital tools and algorithms when working with data from various sources in order to effectively use the information to solve problems;
		GC-7.2 Evaluates information, its reliability, and draws logical conclusions from incoming information and data.

Code	Competence	Competence Formation Indicators (within this discipline)
GPK-4	Suitable of representing, protecting, and disseminating the outcomes of their professional activities.	GPK-4.1 Knows the main results of his/her scientific activity, methods of their presentation, protection and dissemination;
		GPK-4.2. is able to understand and analyze the results of professional activities, use own scientific achievements. discuss and disseminate the results of their professional activities.
		GPK-4.3. Have the skills to analyze, discuss and disseminate the results of professional activities
SPC-1	Capable of processing geological data, modeling ore bodies with modern software, resolving quality and mineral reserve management issues, and developing engineering and geological surveying measures for the territory.	PC-1.1. Knowledge of the basics of geological structure of ore deposits, the possibility of using specialized software

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF HEP HE

Discipline “Digital Technologies in Geology” refers to the Variable Component of block B1 of the HEP HE.

As part of the HEP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline “Digital Technologies in Geology”.

Table 3.1. The list of components of the HEP HE that contribute to the achievement of the planned results of the development of the discipline

Code	Competence	Previous Disciplines (Modules)*	Subsequent Disciplines (Modules)*
GC-1	Able to search, critical analysis of problem situations based on a systematic approach, develop an action strategy.		Groundwater Dinamics; Final state attestation
GC-7	Capable: - search for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data received from various sources in order to		Final state attestation

Code	Competence	Previous Disciplines (Modules)*	Subsequent Disciplines (Modules)*
	effectively use the information received to solve problems; - evaluate information, its reliability, build logical conclusions based on incoming information and data.		
GPK-4	Suitable of representing, protecting, and disseminating the outcomes of their professional activities.		Research Work (Mining Geology). Part 2; Research Work (Geological and Geophysical Survey). Part 2; Final state attestation
SPC-1	Capable of processing geological data, modeling ore bodies with modern software, resolving quality and mineral reserve management issues, and developing engineering and geological surveying measures for the territory.		Pre-graduation Practical Training; Research Work (Geological and Geophysical Survey). Part 1; Research Work (Mining Geology). Part 1; Research Work (Geological and Geophysical Survey). Part 2; Research Work (Mining Geology). Part 2; Final state attestation

* - filled in in accordance with the matrix of competencies and academic curriculum of HEP HE

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Course workload "Digital Technologies in Geology" is 7 credit units.

Table 4.1. Types of academic activities during the period of the HE programme mastering

Type of academic activities		TOTAL, ac. hrs.	Semester	
			1	2
Contact academic hours		*88*	*54*	*34*
Lectures		-	-	-
Lab work		-	-	-
Seminars (workshops/tutorials)		88	54	34
Self-study (ies), academic hours		*128*	*54*	*74*
Evaluation and assessment (exam or pass/fail grading)		*36*	*36 Exam*	*0 fail grading with grade*
Course workload	academic hours	**252**	**144**	**108**
	credits	**7**	**4**	**3**

5. COURSE MODULES AND CONTENTS

Table 5.1. Course Modules and Contents by types of academic activities

Modules	Topics	Type of academic activities*
Section 1. General issues of computer processing of geological information	1.1. Sources and types of geological information, formalization of geological data. Computer representation of raster, vector, numeric and text data, file formats, format conversion, converters	Sem
Section 2. Specialized computer programs used to solve geological problems	2.1. Graphic and text editors for commercial and free use	Sem
	2.2. Programs for analyzing and displaying numerical data. Vectorizers. Programs to build maps in isolines, borehole columns. Programs for processing remote sensing data	Sem
Section 3. General issues of geoinformatics. Organization and visualization of data in GIS	3.1. Geographic information systems (GIS), areas of application, structure, software and hardware	Sem
	3.2. Sources and types of data, input and storage of spatially coordinated and attributive data. Vector and raster data, geodatabases	Sem
Section 4. Spatially coordinated and attributive data transformation and analysis in GIS	4.1. Projection, curvilinear and affine transformations, scaling and generalization. Basic operations with raster data (layer displaying, recoding, overlaying, filtering, calculation of slope, aspect ratio, distances, perimeters, areas, buffer zones and visibility zones detection). Basic operations with vector data (mapping, splitting and merging, topographic overlay, buffering, discrete georeferencing (geocoding). Basic operations with attributive data (statistical analysis, plotting, interpolation). Expert systems	Sem
Section 5. Applied aspects of geoinformatics	5.1. Requirements for the content of databases. Comparative characteristics of the basic tools and software GIS. Examples of GIS implementation. Prospects and trends in the development of geoinformatics in Russia and abroad.	Sem

* - *Lec – Lectures; Lab – Lab work; Sem – Seminars (workshops/tutorials).*

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom Equipment and Technology Support Requirements

Classroom for Academic Activity Type	Classroom Equipment	Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary)
Computer Lab	Computer lab for conducting	Specialized software:

	classes, group and individual consultations, current control and intermediate attestation, equipped with personal computers (21 pcs. computer class equipped with 21 personal computers, a blackboard (screen) and multimedia devices. technical means of multimedia presentations.	• ArcGIS, • QGIS, • SAGA, • STATISTICA, • Surfer, • Erdas Emagine, • Isoline
Seminars	Auditorium for classes seminars, group and individual consultations, current control and intermediate attestation, equipped with a set of a set of specialized furniture and technical means of multimedia presentations.	
Self-studies	Auditorium for independent work (can be used for seminars and consultations), equipped with a set of a set of specialized furniture and computers with access to the EITS of the university.	

7. RECOMMENDED SOURCES FOR COURSE STUDIES

Main reading(sources):

1. Reference systems embedded in QGIS, SAGA, ArcGIS, STATISTICA, Surfer, Erdas Emagine, Isoline

2. Zakharov M.S., Kobzev A.G. Cartographic method and geoinformation systems in engineering geology. Publisher: Lan', 2019. - 116 c. ISBN: 5978-5-8114-4641-4; Same [Electronic resource]. - URL: http://biblioclub.ru/index.php?page=book&id=57174

3. Geoinformation systems : textbook / compilers O.L. Giniyatullina, T.A. Khorosheva. - Kemerovo : KemSU, 2018. - 122 c. - ISBN 978-5-8353-2232-9. - Text : electronic // Lan' : electronic library system. - URL: https://e.lanbook.com/book/120040 - Mode of access: for authorized users.

Additional (optional) reading (sources):

1. Dubrovskiy A. V. Geoinformation systems: automated mapping : tutorial / A. V. Dubrovskiy. - Novosibirsk : SGUGiT, 2021. - 121 c. - ISBN 978-5-907320-82-6. - Text : electronic // Lan' : electronic library system. - URL: https://e.lanbook.com/book/222332 - Mode of access: for authorized users.

2. Geoinformation systems: laboratory practical work : [16+] / author-compiler. O. E. Zelivyanskaya ; North Caucasian Federal University. - Stavropol : North Caucasian Federal University (NCFU), 2017. - 159 c. : ill. - Access mode: by subscription. - URL: https://biblioclub.ru/index.php?page=book&id=483064 - Text : electronic.

Internet-(based) sources:

1. Electronic libraries with access for RUDN students:
- RUDN Electronic Library System – RUDN ELS http://lib.rudn.ru/MegaPro/Web
- ELS "University Library Online" http://www.biblioclub.ru
- ELS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant" www.studentlibrary.ru
- ELS "Lan" http://e.lanbook.com/
- ELS "Trinity Bridge" http://www.trmost.ru

2. Databases and search engines:
- Electronic Fund of Legal and Normative-technical Documentation http://docs.cntd.ru/
- Yandex search engine https://www.yandex.ru/
- Google search engine https://www.google.ru/
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

*Learning toolkits for self- studies in the RUDN LMS TUIS *:*

1. Guidelines for students on the development of the subject "Digital Technologies in Geology".

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

8. ASSESSMENT AND EVALUATION TOOLKIT AND GRADING CRITERIA

Assessment and Evaluation Toolkit (AET), Grading System (GS)* for assessing the level of competence (part of competence) for the subject "Digital Technologies in Geology" are presented in the Appendix to the Course Syllabus of the subject.

* - AET and GS are formed on the basis of the requirements of the relevant local normative act of the RUDN University.

DEVELOPERS:

Senior Lecturer of the Department of Subsoil Use and Oil&Gas Engineering		**V. Markov**
Position, Department	Signature	Full name

HEAD of Department:

Director of the Department of Subsoil Use and Oil&Gas Engineering		**A. Kotelnikov**
Name of Department	Signature	Full name

HEAD OF HEP HE:

Director of the Department of Subsoil Use and Oil&Gas Engineering		**A. Kotelnikov**
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