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

**Academy of Engineering**

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educational division (faculty/institute/academy) as higher education programme developer

**COURSE SYLLABUS**

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**Geological and Geophysical Basics of Mineral Prospecting and Exploration**

course title

**Recommended by the Didactic Council for the Education Field of:**

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**05.04.01 Geology**

field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

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**Mining Geology**

higher education programme profile/specialisation title

**2025**

## 1. COURSE GOAL(s)

The goal of the course “Geological and Geophysical Basics of Mineral Prospecting and Exploration” is to acquire knowledge, skills and experience in the following areas: types of minerals, classification of mineral deposits, their geological structures and compositions, and the variety of geological and geophysical methods for mineral prospecting along with their rational selection. Additionally, it involves characterizing the stages of competence formation and ensuring the achievement of the planned results of the educational programme.

The main objectives of the course are:

- obtaining knowledge about metallic and nonmetallic mineral raw materials;
- getting acquainted with the geological diversity of mineral deposits and their classifications;
- training students in basic geological and geophysical methods for prospecting and predicting mineral deposits, including learning how to apply these methods effectively in specific geological settings across different stages of the geological exploration process.

## 2. REQUIREMENTS TO LEARNING OUTCOMES

The course implementation is aimed at the development of the following competences (competences in part):

*Table 2.1. List of competences that students acquire during the course*

Competence code	Competence descriptor	Competence formation indicators (within this course)
GC-6.	Able to identify and implement the priorities of their own activities and ways to improve it based on self-assessment.	GC-6.1 Controls the amount of time spent on specific activities; GC-6.2. Develops time management tools and methods for accomplishing specific tasks, projects, and goals; GC-6.3 Analyzes one's resources and their limits (personal, situational, time, etc.) to successfully complete the assigned task.
GPC-1.	Capable of using the theoretical foundations of special and new sections of geological sciences to solve professional activity problems.	GPC-1.1. Knows the fundamentals of special and new sections of geological sciences; GPC-1.2. Selects a method or methodology for solving a professional problem; GPC-1.3. Knows how to select a method or methodology for solving a professional problem.
GPC-2.	Able to independently formulating the research objectives and establishing a sequence for resolving professional problems.	GPC-2.1. Knows the basics and methods of organizing research activities, methods of setting goals and methods of achieving them; GPC-2.2. Knows how to develop research methods; GPC-2.3. Has methods of establishing cause-effect relationships and identifying the most significant among them and skills of independent formulation of research objectives.

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Competence formation indicators (within this course)</b>
PC-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. Knows the basics of geological structure of ore deposits, the possibility of using specialized software; PC-1.2. Knows how to apply methods of geological data processing, build ore body models, solve problems on quality and mineral reserves management, develop measures for engineering and geological study of the territory.
PC-2.	Capable of justifying the need, choosing the best methodology, planning, implementing, interpreting results, and supervising geophysical work at various stages of mineral site development.	PC-2.1. Knows the theoretical basics of geophysical research; PC-2.2 Knows how to select the best methodology, design, implement, interpret the results of geophysical works; PC-2.3 Knows how to justify and select optimal methodology, manage geophysical work at different stages of subsoil area development.
PC-4.	Capable of designing, assisting with, and supervising a geologic study of a subsoil area at various stages of development.	PC-4.1 Knows the theoretical basis and methods of geological study of the subsoil area at various stages of its development; PC-4.2 Knows how to apply methodological solutions in the design and implementation of the geological study of a subsoil area at various stages of its development; PC-4.3 Knows how to apply the acquired knowledge and skills in the design, support and management of the geological study of a subsoil area at various stages of its development.

### 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the variable component of (B1) block of the higher educational programme curriculum.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

*Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules</b>	<b>Subsequent courses/modules</b>
GC-6.	Able to identify and implement the priorities of their own activities and ways to improve it		Graduate Qualification Work

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules</b>	<b>Subsequent courses/modules</b>
	based on self-assessment.		
GPC-1.	Capable of using the theoretical foundations of special and new sections of geological sciences to solve professional activity problems.		Hydrogeology; Mining Hydrogeology; Research Work (Mining Geology). Part 1; Research Work (Geological and Geophysical Survey). Part 1; Research Work (Mining Geology). Part 2; Research Work (Geological and Geophysical Survey). Part 2; Graduate Qualification Work
GPC-2.	Able to independently formulating the research objectives and establishing a sequence for resolving professional problems.		Research Work (Mining Geology). Part 1; Research Work (Geological and Geophysical Survey). Part 1; Research Work (Mining Geology). Part 2; Research Work (Geological and Geophysical Survey). Part 2; Applied Groundwater Modeling; Graduate Qualification Work
PC-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.		Research Work (Mining Geology). Part 2; 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; Graduate Qualification Work
PC-2.	Capable of justifying the need, choosing the best methodology, planning, implementing, interpreting results, and supervising geophysical work at various stages of mineral site development.		Pre-graduation Practical Training; Research Work (Geological and Geophysical Survey). Part 2; Research Work (Mining Geology). Part 2; Mining Hydrogeology; Research Work (Geological and Geophysical Survey). Part 1; Research Work (Mining Geology). Part 1; Graduate Qualification Work
PC-4.	Capable of designing, assisting with, and supervising a geologic study of a subsoil area at various stages of development.		Mining Hydrogeology; 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;

Competence code	Competence descriptor	Previous courses/modules	Subsequent courses/modules
			Research Work (Mining Geology). Part 2; Graduate Qualification Work

#### 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course “Geological and Geophysical Basics of Mineral Prospecting and Exploration” is 7 credit units.

*Table 4.1. Types of academic activities during the periods of higher education programme mastering*

Type of academic activities		TOTAL, ac. hrs.	Semesters/ training modules	
			1	2
<i>Contact academic hours</i>		70	36	34
Lectures (LC)		-	-	-
Lab work (LW)		-	-	-
Seminars (workshops/tutorials) (S)		70	36	34
<i>Self-studies</i>		164	108	56
<i>Evaluation and assessment (exam/passing/failing grade)</i>		18	0 <i>Failing grade</i>	18 <i>Exam</i>
<b>Course workload</b>	academic hours	<b>252</b>	<b>144</b>	<b>108</b>
	credits	<b>7</b>	<b>4</b>	<b>3</b>

#### 5. COURSE CONTENTS

*Table 5.1. Course contents and academic activities types*

Course module title	Course module contents (topics)	Academic activities types
Module 1. Subject, history, main issues	1.1. Subject and objects of research. The place of the discipline in the system of sciences. Relationship of the course with the disciplines of the geological and economic cycles. The history of the development of the doctrine of search and exploration of mineral deposits. The most important concepts and terms	S
Module 2. Geology of mineral deposits	2.1. Classification of mineral deposits 2.2. Industrial types of metallic mineral deposits. General information about industrial deposits of metallic minerals. The principles of industrial classification of metallic minerals. Examples of classifications. 2.3. Deposits of ferrous, non-ferrous, noble, rare and rare-earth, radioactive (including uranium) metals. The main (industrial) ore minerals. Characteristics of the most important geological and industrial types of deposits. The largest and unique deposits. The scale of mineral reserves.	S

<b>Course module title</b>	<b>Course module contents (topics)</b>	<b>Academic activities types</b>
	<p>The state of the raw material base, the volume of production of minerals in the world; prices on the world market.</p> <p>2.4. Deposits of non-metallic minerals. General information about industrial deposits of non-metallic minerals. The principles of industrial classification of non-metallic minerals. Examples of classifications. Chemical and agronomic raw materials. Industrial and stone raw materials. Construction materials. Areas of industrial use. Industry requirements to the quality of raw materials, technological types and varieties of minerals. State of the raw material base, the volume of production in the world and Africa; prices on the world market. Characteristics of the most important geological and industrial types of deposits.</p> <p>2.5. Uranium deposits in Africa</p>	
Module 3. Searching for minerals	<p>3.1. Stages and stages of geological exploration. Modern classification of stages and phases</p> <p>3.2. Searching geological criteria (prerequisites) and signs. Definition of the concept of criterion and trait. The meaning of these terms for search geology. Global and regional criteria. Geological and non-geological attributes.</p> <p>3.3. Search for mineral deposits, including uranium ores. Classification of searches according to the conditions and methods of work. Methods of prospecting (mineralogical, geochemical, geophysical, etc.). Searches of overlapped deposits.</p>	S

\* LC - lectures; LW - lab work; S - seminars.

## 6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

*Table 6.1. Classroom equipment and technology support requirements*

<b>Type of academic activities</b>	<b>Classroom equipment</b>	<b>Specialised educational / laboratory equipment, software, and materials for course study (if necessary)</b>
Seminar	A classroom for conducting seminars, group and individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and technical means for multimedia presentations.	Collection of educational geological maps; collection of minerals and rocks.
Seminar	A classroom for conducting seminars, group and individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and technical means for multimedia presentations.	Magnetometer MMP-203 (4 pcs); radiometer SRP-68 (2 pcs); cappameter KM-7 (2 pcs); densitometer (1 pc);

		electronic oscillograph ZET 302 (2 pcs).
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

## 7. RESOURCES RECOMMENDED FOR COURSE STUDY

### *Main reading:*

1. Korobeinikov, A. F. Geology. Prognostication and search for mineral deposits: textbook for undergraduate and graduate / A. F. Korobeinikov. - 2nd ed. amended and supplemented - M.: Publishing house Yurait, 2018. - 254 p. - (Series : Universities of Russia). - ISBN 978-5-534-00747-3.— URL: [www.biblio-online.ru/book/FF44F535-EBFF-4634-A5B8-4CF5514B6EAE](http://www.biblio-online.ru/book/FF44F535-EBFF-4634-A5B8-4CF5514B6EAE)
2. Pivnyak G. et al.(eds.) Mining of Mineral Deposits. Editors: Genadiy Pivnyak, Volodymyr Bondarenko, Iryna Kovalevs'ka and Mykhaylo Illiashov ,CRC Press,2013. — 382 p. — ISBN: 1138001082. URL: <https://sciarium.com/file/190886/>
3. Schluter T. Geological Atlas of Africa (with notes on stratigraphy, tectonics, economic geology, geohazards and geosites each country). New York, 2006, 255 p., ISBN: 3-540-29144-x. URL: <https://www.geokniga.org/books/2719>

### *Additional reading:*

1. Varet J. Geology of Afar (East Africa). Springer, 2018. — 345 p. — (Regional Geology Reviews). — ISBN: 978-3-319-60863-1. URL: <https://sciarium.com/file/304532/>
2. Detay M., Detay A.-M. Geological Wonders of Namibia. Struik Nature, 2017. — 140 p. — ISBN: 9781775842941. URL: <https://sciarium.com/file/295481/>
3. Geology and mineral deposits : textbook for universities / J. V. Seminsky, G. D. Maltseva, I. N. Semeykin, M. V. Yakhno; under the editorship of J. V. Seminsky. - 2nd ed. amended and supplemented - M. : Publishing house Yurait, 2018. - 347 p. - (Series : Universities of Russia). - ISBN 978-5-534-07478-9. - URL: [www.biblio-online.ru/book/1DF31DE8-685C-4F8D-A9D8-9969EC18C5B8](http://www.biblio-online.ru/book/1DF31DE8-685C-4F8D-A9D8-9969EC18C5B8)

### *Internet sources:*

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:
  - RUDN Electronic Library System (RUDN ELS) <http://lib.rudn.ru/MegaPro/Web>
  - EL "University Library Online" <http://www.biblioclub.ru>
  - EL "Yurayt" <http://www.biblio-online.ru>
  - EL "Student Consultant" [www.studentlibrary.ru](http://www.studentlibrary.ru)
  - EL "Lan" <http://e.lanbook.com/>
  - EL "Trinity Bridge" <http://www.trmost.ru>
2. Databases and search engines:
  - electronic foundation of legal and normative-technical documentation <http://docs.cntd.ru/>

- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>

*Training toolkit for self- studies to master the course* \*:

1. Guidelines for students on the development of the course “Geological and Geophysical Basics of Mineral Prospecting and Exploration”.

\* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

## **8. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS’ COMPETENCES LEVEL UPON COURSE COMPLETION**

The assessment toolkit and the grading system\* to evaluate the competences formation level (competences in part) upon the course study completion are specified in the Appendix to the course syllabus.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

### **DEVELOPERS:**

**Associate Professor,  
Department of Subsoil Use and  
Oil&Gas Engineering**

position, educational department

**M. Romero**

name and surname

**Head of the Department of  
Subsoil Use and Oil&Gas  
Engineering**

position, educational department

**A. Kotelnikov**

name and surname

**Associate Professor,  
Department of Subsoil Use and  
Oil&Gas Engineering**

position, educational department

**V. Abramov**

name and surname

### **HEAD OF EDUCATIONAL DEPARTMENT:**

**Department of Subsoil Use and  
Oil&Gas Engineering**

educational department

**A. Kotelnikov**

name and surname

### **HEAD OF HIGHER EDUCATION PROGRAMME:**

**Head of the Department of  
Subsoil Use and Oil&Gas  
Engineering**

position, educational department

**A. Kotelnikov**

name and surname