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ФИО: Ястребов Олег Александрович
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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

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

COURSE SYLLABUS

Geological and Geophysical Basics of Mineral Prospecting and Exploration

course title

Recommended by the Didactic Council for the Education Field of:

05.04.01 Geology

field of studies / speciality code and title

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

Mining Geology

higher education programme profile/specialisation title

1. COURSE GOAL(s)

The goal of the course “Geological and Geophysical Basics of Mineral Prospecting and Exploration” is acquiring knowledge, skills and experience in the field of types of minerals, on the classifications of mineral deposits, their geological structure and composition, on the variety of geological and geophysical methods of mineral prospecting and their rational choice, 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 ore and non-metallic mineral raw materials;
- getting acquainted with the geological diversity of mineral deposits, classifications of deposits;
- training of students in the basic Training of students on basic geological and geophysical methods of prospecting and forecasting of mineral deposits learning how to use them in specific geological environments at 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 Analyze 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. Knowledge of the basics of special and new sections of geological sciences;
		GPC-1.2. Selects a method or technique to solve a professional problem;
		GPC-1.3. Knows how to select a method or method of solving a professional problem.
GPC-2.	Able of 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. is able 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.
PC-1.	Capable of processing geological data, modeling	PC-1.1. Knowledge of the basics of geological structure of ore deposits, the possibility of using specialized software;

Competence code	Competence descriptor	Competence formation indicators (within this course)
	ore bodies with modern software, resolving quality and mineral reserve management issues, and developing engineering and geological surveying measures for the territory.	PC-1.2. Is able 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. Know the theoretical basics of geophysical research; PC-2.2 Know how to select the best methodology, design, implement, interpret the results of geophysical works; PC-2.3 Know 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 Know the theoretical basis and methods of geological study of the subsoil area at various stages of its development; PC-4.2 Be able 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 Be able 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

Competence code	Competence descriptor	Previous courses/modules	Subsequent courses/modules
GC-6.	Able to identify and implement the priorities of their own activities and ways to improve it based on self-assessment.		Final state attestation

Competence code	Competence descriptor	Previous courses/modules	Subsequent courses/modules
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; Final state attestation
GPC-2.	Able of 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; Final state attestation
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; Final state attestation
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;

Competence code	Competence descriptor	Previous courses/modules	Subsequent courses/modules
			Research Work (Geological and Geophysical Survey). Part 1; Research Work (Mining Geology). Part 1; Final state attestation
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; Research Work (Mining Geology). Part 2; Final state attestation

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>	
Course workload	academic hours	252	144	108
	credits	7	4	3

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. The state of the raw material base, the volume of production of minerals in the world; prices on the world market. 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. 2.5. Uranium deposits in Africa	S
Module 3. Searching for minerals	3.1. Stages and stages of geological exploration. Modern classification of stages and phases 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. 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.	S

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

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
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); MERI station (1 pc); 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 c. - (Series : Universities of Russia). - ISBN 978-5-534-00747-3.— URL: 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 r., 255 стр., 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 c. - (Series : Universities of Russia). - ISBN 978-5-534-07478-9. - URL: 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
- 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/>
- 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

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

position, educational department

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

position, educational department

M. Romero

name and surname

A. Kotelnikov

name and surname

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