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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

Hydrogeology

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 “Hydrogeology” is to acquire knowledge, skills and experience in the field of groundwater, their resources and composition, distribution and interaction with the Earth’s crust, management and protection; formation of systems hydrogeological thinking. Additionally, it involves characterizing the stages of competence formation and ensuring the achievement of the planned results of the educational programme.

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)
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.
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-3	Capable of projecting, implementing, and managing a hydrogeological study of the territory during the exploration and development of a mineral deposit.	PC-3.1 Knows the theoretical foundations and methods of hydrogeological study of the territory at the stage of exploration and development of mineral deposits.
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.

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
GPC-1.	Capable of using the theoretical foundations of special and new sections of geological sciences to solve professional activity problems.	Mining Geology; Engineering and Geological Support of Subsoil Use; Geological and Geophysical Basics of Mineral Prospecting and Exploration	Research Work (Mining Geology). Part 2; 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.	Introduction Practical Training; Modelling of Mineral Deposits; Mining Geology; Geological and Geophysical Basics of Mineral Prospecting and Exploration; Regional Geology. Geology of Central and Southern Africa	Research Work (Geological and Geophysical Survey). Part 2; Research Work (Mining Geology). Part 2; Pre-graduation Practical Training; Graduate Qualification Work
PC-3	Capable of projecting, implementing, and managing a hydrogeological study of the territory during the exploration and development of a mineral deposit.	Mineralogy; Mining Geology	Pre-graduation Practical Training; Research Work (Mining Geology). Part 2; Graduate Qualification Work
PC-4.	Capable of designing, assisting with, and supervising a geologic study of a subsoil area at various stages of development.	Modelling of Mineral Deposits; Mining Geology; Geological and Geophysical Basics of Mineral Prospecting and Exploration; Regional Geology. Geology of Central and Southern Africa; Introduction Practical Training	Research Work (Geological and Geophysical Survey). Part 2; Research Work (Mining Geology). Part 2; Pre-graduation Practical Training; Graduate Qualification Work

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course “Hydrogeology” is 5 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
		3
<i>Contact academic hours</i>	54	54
Lectures (LC)	18	18
Lab work (LW)	-	-
Seminars (workshops/tutorials) (S)	36	36
<i>Self-studies</i>	90	90
<i>Evaluation and assessment (exam/passing/failing grade)</i>	36	36 <i>Exam</i>
Course workload	academic hours	180
	credits	5

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1. Fundamental hydrogeology	Topic 1.1. Water in the earth crust	LC
	Topic 1.2. Properties of Aquifers	LC, S
	Topic 1.3 Principles of Ground-Water Flow	LC, S
	Topic 1.4 Types of Aquifers	LC, S
Module 2. Water Chemistry	Topic 2.1. Major ions and trace elements chemistry	LC, S
	Topic 2.2. Organic matter, gas composition and isotopes	LC
	Topic 2.3. Origin of water chemical composition^ mechanisms, stages, factors	LC, S
Module 3. Applied hydrogeology	Topic 3.1 Water Quality and Ground-Water Contamination	LC, S
	Topic 3.2 Ground-Water Development and Management	LC, 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)

Lecture	A lecture hall for lecture-type classes, equipped with a set of specialised furniture; board (screen) and technical means of multimedia presentations.	
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.	
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. Fetter C.W. Applied hydrogeology. Waveland Press, 2018, 621 p., ISBN: 1-4786-3709-9 <https://www.geokniga.org/>
2. Celia M.A., Pinder G.F. Subsurface hydrology. John Wiley & Sons INC, 2006, 483 p., ISBN: 978-0-471-74243-2 <https://www.geokniga.org/>
3. Hiscock K.M. Hydrogeology. Principles and practice. Blackwell science Ltd, 2005, 404 p., ISBN: 0-632-05763-7. <https://www.geokniga.org/>

Additional reading:

1. Sanderson D.J., Zhang X. Numerical modelling and analysis of fluid flow and deformation of fractured rock masses. Elsevier, 2002, 300 p., ISBN: 0-08-043931-4 <https://www.geokniga.org/>
2. Kirsch R. Groundwater geophysics. A tool for hydrogeology. Springer, 2006, 499 p., ISBN: 978-3-540-29383-5 <https://www.geokniga.org/>
3. Kovalevsky V.S., Kruseman G.P., Rushton K.R. Groundwater studies. Paris, 2004, 430 p., ISBN: 92-9220-005-4. <https://www.geokniga.org/>

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. The set of lectures on the course “Hydrogeology”.
2. Guidelines for students on the development of the course “Hydrogeology”.

* 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:

**Professor, Department of
Geology, School of Earth
Sciences and Engineering, TPU**
position, educational department

N. Guseva
name and surname

**Researcher in the Department
of Geology, School of Earth
Sciences and Engineering, TPU**
position, educational department

D. Purgina
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