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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

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

COURSE SYLLABUS

Hydrogeology

(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)

1. AIMS AND OBJECTIVES

The purpose of mastering the discipline “Hydrogeology” is acquiring 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, characterizing the stages of competence formation and ensuring the achievement of the planned results of the educational programme.

2. REQUIREMENTS TO LEARNING OUTCOMES

Mastering the discipline “Hydrogeology” 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)
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.
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.
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 Know 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 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.

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

Discipline “Hydrogeology” refers to the University Disciplines Module 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 “Hydrogeology”.

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)*
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; 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.	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; Final State Attestation
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; Final State Attestation
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; 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 “Hydrogeology” is 5 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
		3
<i>Contact academic hours</i>	<i>54</i>	<i>54</i>
Lectures	18	18

Type of academic activities		TOTAL, ac. hrs.	Semester
			3
Lab work		-	-
Seminars (workshops/tutorials)		36	36
<i>Self-study (ies), academic hours</i>		90	90
<i>Evaluation and assessment (exam or pass/fail grading)</i>		36	36 <i>Exam</i>
Course workload	academic hours	180	180
	credits	5	5

5. COURSE MODULES AND CONTENTS

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

Modules	Topics	Type of academic activities*
Module 1. Fundamental hydrogeology	Topics 1.1. Water in the earth crust	Lec
	Topics 1.2. Properties of Aquifers	Lec, Sem
	Topics 1.3 Principles of Ground-Water Flow	Lec, Sem
	Topics 1.4 Types of Aquifers	Lec, Sem
Module 2. Water Chemistry	Topics 2.1. Major ions and trace elements chemistry	Lec, Sem
	Topics 2.2. Organic matter, gas composition and isotopes	Lec
	Topics 2.3. Origin of water chemical composition^ mechanisms, stages, factors	Lec, Sem
Module 3. Applied hydrogeology	Topics 3.1 Water Quality and Ground-Water Contamination	Lec, Sem
	Topics 3.2 Ground-Water Development and Management	Lec, 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)
Lecture	Auditorium for lecture-type classes, equipped with a set of specialized furniture; blackboard (screen) and technical a set of specialized furniture, a board (screen), and technical means of multimedia presentations.	
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. Fetter C.W. Applied hydrogeology. Waveland Press, 2018 г., 621 стр., ISBN: 1-4786-3709-9 <https://www.geokniga.org/>
2. Celia M.A., Pinder G.F. Subsurface hydrology. John Wiley & Sons INC, 2006 г., 483 стр., ISBN: 978-0-471-74243-2 <https://www.geokniga.org/>
3. Hiscock K.M. Hydrogeology. Principles and practice. Blackwell science Ltd, 2005 г., 404 стр., ISBN: 0-632-05763-7. <https://www.geokniga.org/>

Additional (optional) reading (sources):

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

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 “Hydrogeology”.
2. Course of lectures on the subject “Hydrogeology”.

* - 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 “Hydrogeology” 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:

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