

Документ подписан простой электронной подписью
Информация о владельце:
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Должность: Ректор
Дата подписания: 07.07.2023 10:08:36
Уникальный программный ключ:
ca953a0120d891083f939673078ef1a989dae18a

**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

Groundwater Dynamics

(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 “Groundwater Dynamics” is acquiring knowledge, skills and experience in the field of quantitative laws of groundwater movement in the Earth's crust, 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 “Groundwater Dynamics” 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-2.	Able to manage a project at all stages of its life cycle	GC-2.1. Formulates a problem whose solution is directly related to the achievement of the project goal; GC-2.2 Identifies the connections between the tasks and the expected results of their solution; GC-2.3 Identifies the available resources and constraints within the assigned tasks and the applicable legal regulations.
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

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

Discipline “Groundwater Dynamics” 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 “Groundwater Dynamics”.

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	Modelling of Mineral Deposits	Final State Attestation

Code	Competence	Previous Disciplines (Modules)*	Subsequent Disciplines (Modules)*
	systematic approach, develop an action strategy.		
GC-2.	Able to manage a project at all stages of its life cycle	<i>Innovative Remote Sensing Methods in Geology**</i> ; <i>Geoinformation Systems for Geology Based on Space Imagery**</i> ; Digital Technologies in Geology	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.	<i>Mineralogy</i> ; Mining Geology	Pre-graduation Practical Training; Research Work (Mining Geology). Part 2; Final State Attestation

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

** - elective disciplines/practices

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Course workload “Groundwater Dynamics” is 4 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>	54	54
Lectures	18	18
Lab work	-	-
Seminars (workshops/tutorials)	36	36
<i>Self-study (ies), academic hours</i>	72	72
<i>Evaluation and assessment (exam or pass/fail grading)</i>	18	18 <i>Exam</i>
Course workload	academic hours	144
	credits	4

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. Principles of Ground-Water Flow	Topic 1.1. General Laws	Lec, Sem
	Topics 1.2 Equations of Ground-Water Flow	Lec, Sem
Module 2. Ground-Water Flow to Wells	Topics 2.1. Computing Drawdown Caused by a Pumping Well	Lec, Sem
	Topics 2.2. Determining Aquifer Parameters from Time-Drawdown Data	Lec, Sem

Modules	Topics	Type of academic activities*
	Topics 2.3 Estimating Aquifer Transmissivity from Specific Capacity Data	Lec, Sem
	Topics 2.4 Intersecting Pumping Cones and Well Interference	Lec, Sem
	Topics 2.5 Effect of Hydrogeologic Boundaries	Lec, Sem
	Topics 2.6 Aquifer-Test Design	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. Mazor E. Global water dynamics: Shallow and deep groundwater, petroleum hydrology, hydrothermal fluids, and landscaping. Marcel Dekker Inc, 2004 г., 403 стр. <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/>

4. Bloetscher F. Manual of water supply practices. Groundwater. American Water Works Association, 2014 г., 295 стр., ISBN: 978-1-58321-964-5. <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 “Groundwater Dynamics”.

2. Course of lectures on the subject “Groundwater Dynamics”.

* - 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 “Groundwater Dynamics” 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:

**Professor, Department of
Geology, School of Earth Sciences
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Position, Department

Signature

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