

TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV
INSTITUTE OF GEOLOGY

Department: **Petroleum Geology**

«APPROVED»
Deputy Director on academic work


« 01 » 09 2023

WORK PROGRAMME OF THE DISCIPLINE
Hydrogeophysics

for student

Branch of knowledge *10 Natural Sciences*
Training direction *103 Earth Sciences*
(Specialty)
Educational level *master*
Educational program *Petroleum Geology*
Type of discipline *mandatory*

Teaching mode *full-time studies*
Academic year *2023/2024*
Semester *1*
Number of credits ECTS *4*
Language of teaching, learning and evaluation *English*
Form of final control *modular test*

Lecturer: : *Iryna BAYSAROVYCH, PhD in Geology, Associate professor, Department of Petroleum Geology*

To be continued

for 20__/20__ (_____) «__» 20__
for 20__/20__ (_____) «__» 20__
for 20__/20__ (_____) «__» 20__

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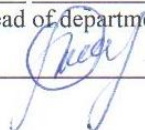
Kyiv - 2023

Author(s): Iryna BAYSAROVYCH, PhD in Geology, Associate professor, Department of Petroleum Geology

APPROVED

2023

Head of department of Petroleum Geology



(Viktor OHAR)

Protocol N1 31.08.2023

Approved by Scientific-methodical Commission of Institute of Geology

Protocol N1 31.08.2023

Head of the scientific methodical commission  (Vsevolod DEMIDOV)

The aim of the discipline - is to familiarize students with the main ideas about the new applied direction in studying the near-surface geological section (shallow subsurface), based on the fundamental development of the cycle of natural sciences: geophysics (direct and remote methods for studying the geological environment) and hydrogeology (study of the geofiltration parameters of aquifers and complexes). The tasks of the course include consideration of all research methods that allow realizing an integrated assessment of the hydrogeological section and analyze the influence of heterogeneity on distribution of contamination in the unsaturated (vadoze) zone and in groundwater.

Preliminary requirements:

1. basic knowledge of geophysics and hydrogeology
2. the level of English proficiency not lower than B1.

Annotation of discipline:

Academic discipline "Hydrogeophysics" that integrates the principles of classical natural sciences is part of education and professional training program for the education level "master" branch of knowledge 10 - Natural Science of speciality 103 - Earth Sciences, educational program – "Petroleum Geology".

This discipline is obligatory for educational program "Petroleum Geology".

The discipline is taught in the 1st semester of 1 year Master's degree program in volume - 120 hours (4 credits ECTS) including lectures - 24 hours, seminars - 14 hours, consultations - 2 hours, self-study work - 80 hours.

The tasks of the discipline – to highlight the following issues:

- Groundwater pollution and hydrogeological parameters of aquifers;
- Traditional hydrogeological methods for Hydraulic conductivity estimation
- The potential of direct and indirect geophysical methods in solving hydrogeological problems.
- The current research methods that make it possible to estimate the spatial variability of Hydraulic conductivity in shallow subsurface aquifers in the section of the well.
- Modern state of development of the newest research methods that will enable in the future to estimate the spatial variability of Hydraulic conductivity (K) between wells.
- Disadvantages and advantages of all groups of methods for estimating spatial variability of Hydraulic conductivity in shallow subsurface.

The achievement of the stated educational goals will facilitate the acquisition of the following general competences by students:

- Ability to work in the international context. Ability for writing and verbal communication in Ukrainian and foreign languages.
- Knowledge of modern principles of nature management, interaction of nature and society with the use of rational use of natural resources, environmental aspects and basics of environmental legislation.
- Understanding of a planet as a unique single system, the most important issues of its inner structure and evolution.
- Possession of modern research methods used in production and research organizations in the study of the Earth, geological environment, oil and gas fields (facilities) and territories.

The results of study:

Learning outcomes of the discipline (1. to know; 2. be able to; 3. communication; 4. autonomy and responsibility)		<i>Methods of teaching and learning</i>	<i>Assessment methods</i>	<i>Percentage in the final assessment of the discipline</i>
1.1	To know function of ground-water systems	<i>Lecture, seminar</i>	Paperwork	<i>up to 10%</i>
1.2	To know water well design and sanitary zones	<i>Lecture, seminar</i>	Paperwork	<i>up to 5%</i>
1.3	To know traditional methods for determining the hydrogeological parameters of the aquifers;	<i>Lecture, seminar</i>	Paperwork	<i>up to 15%</i>
1.4	To understand the integration principles of geophysical and hydrogeological measurements	<i>Lecture, seminar</i>	Paperwork	<i>up to 5%</i>
1.5	To know modern methods of determining the heterogeneity of parameters (in particular, the hydraulic conductivity) in the area of distribution of water-bearing rocks of shallow subsurface;	<i>Lecture, seminar</i>	Paperwork	<i>up to 15%</i>
1.6	To know new generation methods for determining the filtration parameters within the framework of Hydrogeophysics.	<i>Lecture, seminar</i>	Paperwork	<i>up to 15%</i>
2.1	To define a complex of methods for studying spatial variability of hydraulic conductivity in terms of the features of the geological section;	<i>Lecture, seminar</i>	Paperwork	<i>up to 10%</i>
2.2	To assess the petrochemical pollution of groundwater and vadoze zone	<i>Lecture, seminar</i>	Paperwork	<i>up to 10%</i>
3.1	Communicate information on hydrogeophysics (its methods and research results) to specialists and non-specialists, including in the international context.	<i>Lecture, seminar</i>	Paperwork	<i>up to 10%</i>
4.1	To act socially responsible and consciously in the international working group.	<i>lecture</i>	Paperwork	<i>up to 5%</i>

The correlation of the learning outcomes of the discipline with the program results

Learning outcomes of the discipline Program learning outcomes	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	3.1	4.1
	PR01. To analyze the features of natural and anthropogenic systems and objects of the Earth's Geospheres, taking into account oil and gas potential of the subsoil	+		+		+	+	+	+	
PR02. To apply their own knowledge to identify and solve problems and make informed decisions in the Earth sciences.		+		+	+		+			
PR06. To be able to carry out environmental assessment, audit, licensing, and certification of natural resources; predict the development of environmental, technological, economic and social consequences at individual sites of nature management.		+			+			+	+	+
PR07. To know modern methods of studying the Earth and its geospheres and be able to apply them in production and research activities.			+	+	+	+			+	

Structure of discipline: lectures, seminars, self-studying work of student

Scheme of grading forms:

Form of student evaluation:

- semester grading:

1. Control test - (min - 6, max - 10 grades)
2. Control test - (min - 6, max - 10 grades)
3. Works paper and oral reports (min - 38, max - 60 grades)

- final assessment (modular test) in form of the written test (min - 12 , max - 20 grades)

Final evaluation is in the form of a modular test (total score of discipline (maximum 100 grades) is defined as the sum for the systematic work during the semester). Final evaluation is based on the results of the student's work throughout the semester. The Modular test is not obligatory.

For students who have obtained total grades less than critically-calculated minimum of 20 grades repeated control test is obligatory for taking the test. The modular test can not be less than 12 grades in order to obtain a general positive assessment for the course.

Grading: For admission to the final grading it is obligatory: 1) to pass two control tests; 2) to prepare six oral reports, which can be presented in the form of presentations and abstracts. The final grading is carried out in the form of written modular test.

Assessment:

Conformity scale

Passed	60-100
Fail	0-59

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STRUCTURE OF THE DISCIPLINE
PLAN OF LECTURES AND SEMINARS

#	Theme	Hours		
		Lectures	Seminars	Self - studying work
1	Theme 1. Introduction to Hydrogeophysics	2		6
2	Theme 2. Water well design and sanitary zones. Function of ground-water systems within the shallow subsurface.	4	2	10
3	Theme 3. Cone of depression. Pumping test and slug test as common hydrogeological method of hydraulic conductivity estimation for water-supply investigations.	2	2	10
4	Theme 4. <i>Laboratory analyses of core samples for K estimation</i>	2	2	10
5	Theme 5. Types of geophysical logging that are used to solve hydrogeological problems	2	2	10
	<i>Test 1</i>			2
6	Theme 6. The current research methods that make it possible to estimate the spatial variability of Hydraulic conductivity in shallow subsurface aquifers in the section of the well.	4	2	10
7	Theme 7. Modern state of development of the newest research methods that will enable in the future to estimate the spatial variability of K between wells.	4	2	10
8	Theme 8. Contamination of groundwater. Petroleum products pollution of groundwater and vadoze zone	4	2	10
	<i>Test 2</i>			2
	Total	24	14	80

Total hours of the discipline - 120, that include:

Lectures - **24 hrs**

Seminars - **14 hrs**

Consultations - **2 hrs**

Self-studying work - **80 hrs**

RECOMMENDED LITERATURE

Basic:

1. *Hydrogeophysics*. Yoram Rubin, Susan S. Hubbard. Springer: The Netherlands. – 2005.
2. *Basic Ground-Water Hydrology*. Ralph C. Heath. U.S. Geological Survey Water- Supply Paper 2220. United States Government Printing office: 1989. - 85 p.
3. *Groundwater in Geologic Processes*. Cambridge University Press. S.E. Ingebristen, W.E. Sanford. 1998. - 341 p.
4. Near Surface Geophysics. Volume 5, Number 3, June 2007. PP. 183-194.
5. *Hydrogeology: principles and practice* / Kevin M. Hiscock and Victor F. Bense. – Second edition. Wiley Blackwell. 2014. -519 p.

Additional:

1. *Press Frank, Silver Raymond*. Understanding Earth. New York. W. H. Freeman and Company, Second ed, 1998. 682 p.
2. Горбань І.В., Байсарович І.М., Вижва С.А. Екологія водних ресурсів та природних систем: Навч.посібник. –К.: ВГЛ "Обрії", 2003. –35 с.
3. **THE LEADING EDGE**. NOVEMBER 1997. Vol.16. №11. p.1589

ADDITION №1

to the working program of the academic discipline:
«Hydrogeophysics»

Branch of knowledge	<i>10 Natural Sciences</i>
Training direction (Specialty)	<i>103 Earth Sciences</i>
Educational level	<i>master</i>
Educational program	<i>“Petroleum Geology”</i>
Semester	<i>1</i>
Number of credits ECTS	<i>4</i>
Number of people	<i>5</i>

STRUCTURE OF THE DISCIPLINE

PLAN OF LECTURES AND SEMINARS

#	Theme	Hours		
		Lectures	Seminars	Self-studying work
1	Theme 1. Introduction to Hydrogeophysics	2 /2*		6/12*
2	Theme 2. Water well design and sanitary zones. Function of ground-water systems within the shallow subsurface.	4/2*	2/2*	10/10*
3	Theme 3. Cone of depression. Pumping test and slug test as common hydrogeological method of hydraulic conductivity estimation for water-supply investigations.	2/1*	2/2*	10/12*
4	Theme 4. <i>Laboratory analyses of core samples for K estimation</i>	2/2*	2/2*	10/10*
5	Theme 5. Types of geophysical logging that are used to solve hydrogeological problems	2/1*	2/2*	10/10*
	<i>Test 1</i>			2/2*
6	Theme 6. The current research methods that make it possible to estimate the spatial variability of Hydraulic conductivity in shallow subsurface aquifers in the section of the well	4/1*	2/2*	10/11*
7	Theme 7. Modern state of development of the newest research methods that will enable in the future to estimate the spatial variability of K between wells.	4/1*	2/2*	10/12*
8	Theme 8. Contamination of groundwater. Petroleum products pollution of groundwater and vadoze zone	4/2*	2/2*	10/12*
	<i>Test 2</i>			2/2*
	Total	24/12*	14/14*	80/93*

Total hours of the discipline – 120, that include:

Lectures – **24 hrs/12* hrs**

Seminars - **14 hrs/14* hrs**

Consultations - **2 hrs/1* hrs**

Self-studying work - **80 hrs/93* hrs**