TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV

INSTITUTE OF GEOLOGY

Department: **Petroleum Geology**

«APPROVED»
Deputy Director on academic work
_____
«30» 08 2024

WORK PROGRAMME OF THE DISCIPLINE
Earth's Deep Underground Hydrosphere
(Глибинна гідросфера Землі)

for student

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

Teaching mode	*full-time studies*
Academic year	*2024/2025*
Semester	*2*
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__

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Kyiv - 2024

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

APPROVED
____ _____ 2024
Head of department of Petroleum Geology
_____ _____ (*Viktor OHAR*)
Protocol #

Approved by Scientific-methodical Commission of Institute of Geology

Protocol # 1
Head of the scientific methodical commission _____ (Vsevolod DEMIDOV)
(signature)

«30» 08 2024

The aim of the discipline - is to familiarize students with the basic modern views on the peculiarity of the structure of the deep Tectonosphere and the Hydrosphere and the existing mechanisms for the transfer of matter (including hydrocarbons) and energy. The subject of study is the establishment of interrelationships between physical fields and environmental parameters that determine the processes of solute transport in the deep zones of the Earth.

Preliminary requirements:

1. basic knowledge of tectonics, the basics of geophysics, hydrogeology, geology of oil and gas
2. the level of English proficiency not lower than B1.

Annotation of discipline:

Academic discipline "Earth's Deep Underground Hydrosphere" that integrates the principles of classical natural sciences is part of education and professional training program for the education level "master" branch of knowledge: Natural Sciences, Mathematics and Statistics; E4 Natural Science; Educational program: Petroleum Geology.

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

The discipline is taught in the 1nd semester of 1 year Master's degree program in volume - 120 hours (4 credits ECTS) including lectures - 24 hours, practical classes - 14 hours, consultations - 2 hours, self-study work - 80 hours. The course content provides two modules and two module tests. The discipline is finished by test.

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

- planetary deep geological and geophysical section of the Earth;
- global structures and fluid systems and their distribution;
- methods of study of deep processes;
- the nature of the connections between the parameters of the medium (permeability, porosity, temperature, pressure);
- the mechanisms of transport of matter (solutions) and energy (heat fluxes);
- links between hydrogeological parameters and seismic activity, induced seismicity.

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.
- Knowledge of the basic modern principles of the fundamental sciences regarding the origin, development and structure of the universe, the ability to apply them to form a worldview.

The results of study:

Learning results (1. to know; 2. be able to; 3. communication; 4. autonomy and responsibility)		*Methods of teaching and learning*	*Assessment methods*	*Percentage in the final assessment of the discipline*
1.1	planetary geological and geophysical section and the limits of distribution of the fluids of the corresponding composition	*Lecture, practical class*	Paperwork	*5%*
1.2	the nature of the connections between the parameters of the medium (permeability, porosity, temperature, pressure)	*Lecture, practical class*	Paperwork	*5%*
1.3	mechanisms of transport of matter (soluts) and energy (heat flows)	*Lecture, practical class*	Paperwork	*10%*
1.4	the main interconnections between the processes of mass transport and heat transport in the deep layers of the Earth, including the petroleum system	*Lecture, practical class*	Paperwork	*10%*
1.5	Physical-geological preconditions of interconnections of seismic processes and hydrogeological conditions of environment. Induced seismicity	*Lecture, practical class*	Paperwork	*10%*
1.6	general principles of choice and substantiation of liquid filtration models in the deep layers of the Earth	*Lecture*	Paperwork	*10%*
2.1	use the data of geothermal research in the study of the deep hydrosphere, the formation of deposits of thermal waters and hydrocarbons	*Lecture, practical class*	Paperwork	*15%*
2.2	to identify "masking" effect of relief and aquifers on local parameters of a heat flow	*lecture*	Paperwork	*10%*
2.3	to plan the integrated assessments of the impact of anthropogenic pressure on the induced seismicity	*lecture*	Paperwork	*5%*
3.1	Ability to communicate in a foreign language (English)	*practical class*	Paperwork	*15%*
4.1	Ability to work in an international context and in global information by specialty	*practical class*	Paperwork	*5%*

The correlation of the learning outcomes of the discipline with the "Hydrogeology" 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	2.3	3.1	4.1
PR01. To analyze the features of natural and anthropogenic systems and objects of the Earth's Geosphere							+	+	+		+
PR03. Be able to communicate with specialists and experts of various levels in other fields of knowledge, including in the international context, in the global information environment										+	+
PR07. Know modern methods of researching the Earth and its geospheres, in particular the geological environment and underground hydrosphere, and be able to apply them in production and research activities.	+	+	+	+	+	+	+	+	+	+	+

Structure of discipline: lectures, seminars, independent study 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 - 32, 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 final test (total score of discipline (maximum 100 grades) is defined as the sum for the systematic work during the semester).

Final evaluation based on the results of the student's work throughout the semester.
Procedure and evaluation system

	Semesters grades	Modular test	Final grade
Min	*48*	*12*	*60*
Max	**80**	**20**	**100**

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 cannot 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

STRUCTURE OF THE DISCIPLINE

PLAN OF LECTURES AND SEMINARS

#	Theme	Hours		
		Lectures	**Seminars**	**Independent study work**
Module 1. Internal heat and matter				
1	**Theme 1.** Introduction. Earth as an evolving Planet.	2	2	9
2	**Theme 2.** Earth's internal heat. Heat flow.	4	2	14
3	**Theme 3.** Geothermal Processes.	4	2	10
4	**Theme 4.** Fluids in the crust. Petroleum system. "windows" of hydrocarbon generation .	6	2	10
	Test 1			2
Module 2. Concept of the system of natural circulation of groundwater and consequences of violation of its functioning from anthropogenic activities				
5	**Theme 5.** Conceptualizing Groundwater Systems. Sources of water on a planet	2	2	10
6	**Theme 6.** Relationship between hydrological condition and seismic activity. Induced seismicity.	4	2	14
7	**Theme 7.** Solute transport	2	2	10
	Test 2			2
	Total	**24**	**14**	**81**

Total hours of the discipline – *120, that include:*

Lectures ***– 24*** *hrs*

Practical classes - ***14*** *hrs*

Consultations - ***1*** *hrs*

Independent study work ***- 81*** *hrs*

RECOMMENDED LITERATURE

Basic:

1. An Introduction to the World's Oceans, Seventh edition. McGraw-Hill Higher education. New York. 2003. - 521 p.
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. Basin Analysis: principles and application to petroleum play assessment / Philip A. Allen, Department of Earth Science & Engineering, Imperial College London & John R. Allen. Third edition. 2014. - 619 p.
4. *Don L. Anderson "Theory of the Earth"* Seismological Laboratory. California Institute of Technology Pasadena, California Blackwell Scientific Publications, 1989, p 45-46.
5. *Groundwater in Geologic Processes. Cambridge University Press. S.E. Ingebristen, W.E. Sanford. 1998. - 341 p.*
6. *Understanding Earth. Second Edition. Harvard University. W.H. Freeman and Company.* New York. 1998. - 682 p.
7. *White W.M. Geochemistry. Washington: Mineral. Soc. Amer., 2001. - 701 p.*

Additional:

1. *Горбань І.В., Байсарович І.М., Вижва С.А.* Екологія водних ресурсів та природних систем: Навч. посібник. –К.: ВГЛ "Обрії", 2003. –35 с.
2. Гордієнко В.В., Гордієнко І.В. Завгородня О.В. та ін. Геотермічний атлас України. – К.: 2004 . -60 с.
3. *Geologica. Earth's Geological Past. Millenium House Pty Ltd. Australia. – 2007. - 576 p.*
4. Fyfe W.S. etc. Fluids in the Earth's Crust: Their Significance in Metamorphic, Tectonic and Chemical Transport Processes (Developments in geochemistry) Elsevier Science Ltd. - 402 p.
5. Won-Young Kim. Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio// Journal of Geophysical Research: Solid Earth - 2013. Vol 118 Issue7.
6. Scientific Rationale for Establishment of an International Program of Continental Scientific Drilling. / Report of the International Meeting on Continental Scientific Drilling. Potsdam, Germany, Aug. 30-Sept.1, 1993.