

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
GEOLOGY AND UNCONVENTIONAL HYDROCARBONS
RESEARCH

for student

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>
Type of discipline	<i>Mandatory</i>

Teaching mode	<i>full-time studies</i>
Academic year	<i>2023/2024</i>
Semester	<i>2</i>
Number of credits ECTS	<i>3</i>
Language of teaching, learning and evaluation	<i>English, Ukrainian</i>
Form of final control	<i>exam</i>

Lecturers: *OHAR Viktor*, Doctor of Geology, Professor *KARPENKO Oleksiy*, Doctor of Geology, Professor; ; *BAYSAROVYCH Iryna*, 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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Baysarovich Iryna, 2023

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APPROVED

31 08 2023

Head of department of Petroleum Geology

(signature) (OHAR Viktor)

Protocol # 31.08.2023

Approved by Scientific-methodical Commission of Institute of Geology

Protocol # 31.08.2023

Head of the scientific methodical commission (signature) (DEMYDOV V.)

«31» 08 2023

The aim of the discipline - is to familiarize students with various types of unconventional sources of hydrocarbons in the world, with the structure and characteristics of potentially promising shale basins of the world, most important oil and gas-bearing regions of Ukraine, and promising stratigraphic complexes, methods of their research and evaluation. Familiarization with the methods and technologies of studying and developing unconventional sources of hydrocarbons. Improving professional English skills.

Preliminary requirements:

1. basic knowledge of physics, chemistry (at the level of non-major specialties of higher education institutions); basics of petrophysics, petrography of sedimentary rocks, basics of oil and gas extraction technology; English language proficiency.
2. Successful mastering of the disciplines "Geochemistry of oil and gas", "Geology of oil and gas bearing basins of Ukraine", "Modelling of mineral deposits", "Hydrogeophysics", "Earth's Deep Underground Hydrosphere".basic knowledge of tectonics, the basics of geophysics, hydrogeology, geology of oil and gas.
3. Have basic skills in working with a personal computer.

Annotation of discipline:

The discipline is focused on the study of geological features of unconventional sources of hydrocarbons - shale rocks, compacted reservoirs, combustible gases of coal basins. A "hydrocarbon revolution" took place in the world, which led to a significant redistribution of gas and oil supply sources, a change in priorities - geological, energy, economic, political, ecological, social aspects. The peculiarities of placement in the earth's crust and within individual oil and gas bearing basins of strata containing unconventional hydrocarbons are considered. The educational discipline covers all important issues related to the origin, genetic types of deposits of unconventional sources of hydrocarbons, their distribution, methods of study, as well as existing technologies for the development of shale gas and oil deposits, methane of coal basins, combustible gases of compacted reservoir rocks. Academic discipline is taught in English, adapted and aimed at increasing the students' level of professional English.

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

- classification and geological features of unconventional accumulations/sources of hydrocarbons;
- origin, genetic types of deposits of unconventional sources of hydrocarbons;

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

- Knowledge of methodological knowledge regarding the evaluation of promising resources of unconventional sources of hydrocarbons;
- Basic knowledge of ensuring environmental safety and environmental monitoring during geological exploration and industrial development of unconventional hydrocarbon deposits;
- Ability for verbal communication in foreign language.

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	Modern problems of unconventional sources of hydrocarbons in Ukraine and the world, taking into account environmental aspects;	Lecture, Self-studying work	Paperwork,	up to 5%
1.2	Modern research methods of potentially oil and gas-bearing structures and strata, promising for the detection of oil and gas deposits in low-permeable rocks (shales, mudstones, siltstones, and sandstones);	Lecture, Self-studying work	Paperwork,	up to 5%
1.3	Peculiarities of genesis and placement of unconventional hydrocarbon deposits in sedimentary strata and methane deposits in coal basins;	Lecture, Self-studying work	Paperwork	up to 5%
2.1	To apply knowledge and necessary practical skills in the organization and research of low-permeable potential oil-and-gas-bearing rocks	Lecture, Self-studying work	Paperwork	up to 5%
2.2	To design, organize and carry out field and chamber work, laboratory research of promising objects for unconventional types of hydrocarbon raw materials.	Lecture, Self-studying work	Paperwork	up to 5%
3.1	Ability to communicate in a foreign language (English). / The ability to communicate with specialists and experts of various levels in other fields of knowledge Здатність спілкуватися з фахівцями та експертами різного рівня інших галузей знань.	Lecture, Self-studying work	Paperwork	up to 5%
3.2	Ability to work in an international context and in global information by specialty. / The ability to work in an international context and in a global information environment by profession. Ability to write and speak in Ukrainian and foreign languages. Здатність працювати в міжнародному контексті та в глобальному інформаційному середовищі за фахом. Здатність до письмової та усної комунікації українською та іноземними мовами.	Lecture, Self-studying work	Paperwork	up to 5%
4.1	Ability to adapt and act in a new situation associated with the use of unconventional	Lecture, Self-studying work	Paperwork	up to 5%

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
	sources of hydrocarbons. Ability to act socially responsibly and consciously.			
4.2	Ability to develop and manage projects in the field of studying structures and stratons potentially promising for unconventional sources of hydrocarbons	Lecture, Self-studying work	Paperwork	up to 10%

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

The correlation of the learning outcomes of the discipline with the “Hydrogeology” program results

Program learning outcomes	Learning outcomes of the discipline									
	1.1	1.2	1.3	2.1	2.2	3.1	3.2	4.1	4.2	
(PR01) To analyze the features of natural and anthropogenic systems and objects of the Earth's Geosphere, taking into account the oil and gas potential.	+	+	+		+	+	+		+	
(PR02) To apply one's own knowledge to identify and solve problematic issues and make informed decisions in the field of Earth sciences.	+		+	+	+					
(PR03) To be able to communicate with specialists and experts of various levels in other fields of knowledge, including in an international context, in a global information environment. Ability to write and speak in Ukrainian and foreign languages.						+	+	+		
(PR 14) To perform resource assessment and calculation of reserves of oil, combustible gases, gas condensate.				+	+				+	

Scheme of grading forms:

Form of student evaluation:

- semester grading:

1. Control work #1 - (min - 12, max - 20 grades)
2. Control work #2 - (min - 12, max - 20 grades)
3. Control work #2 - (min - 12, max - 20 grades)

- final assessment

The final evaluation is conducted in the form of a written & oral exam: the maximum score is 40 points, minimal score is 24 points. During the exam, the student provides information on the main types of unconventional sources of hydrocarbons, their distribution in Ukraine and the world, studying methodology, ecological aspects of the development of unconventional hydrocarbon deposits using the acquired knowledge and skills. The exam is held in English.

Final assessment in the form of an exam is mandatory.

The results of students' educational activities are evaluated on a 100-point scale.

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

Procedure and evaluation system

	Semesters grades	Exam	Final grade
Min	36	24	60
Max	60	40	100

A student is not admitted to the final assessment in the form of an exam if he scored less than 20 points during the semester.

Grading: For admission to the final grading it is obligatory to complete 3 written control papers. The final grading is carried out in the form of written and oral exam.

Assessment:
Conformity scale

Відмінно / Excellent	90-100
Добре / Good	75-89
Задовільно / Satisfactory	60-74
Незадовільно / Fail	0-59

**STRUCTURE OF THE EDUCATIONAL DISCIPLINE THEMATIC
PLAN OF LECTURES AND INDEPENDENT LESSONS**

#	Theme	Hours	
		Lectures	Self – studying work
<i>Chapter 1. Basic information about hydrocarbon deposits associated with shale formations, coal deposits, and tight reservoirs</i>			
1	Introduction Theme 1. Unconventional hydrocarbons: origin and classification	2	4
2	Theme 2. Shale oil and gas. Gas deposits in compacted collectors.	4	4
3	Theme 3. Methane of coal basins.	2	4
4	Theme 4. Geological and geographical features of the distribution of hydrocarbon deposits of unconventional type.	2	8
	<i>Control work #1</i>		2
<i>Chapter 2 Methods of research and assessment of the resource base of hydrocarbons of unconventional fields / deposits. Petrographic and petrophysical features of gas shale and compacted reservoirs</i>			
5	Theme 5. Petrographic and petrophysical features of reservoir rocks of unconventional type hydrocarbon deposits. Geophysical methods of diagnostics of hydrocarbon deposits of unconventional type.	4	4
6	Theme 6. Methods of estimating resources and reserves of hydrocarbons of unconventional fields / deposits.	2	4
7	Theme 7. Peculiarities of the development of hydrocarbon deposits of unconventional type. Methods of control over the development of deposits.	2	8
	<i>Control work #2</i>		2
<i>Chapter 3 Environmental aspects of exploration, study and development of unconventional hydrocarbon deposits</i>			
8	Theme 8. General ecological, social and political consequences of	4	8

	increasing the resource base and volumes of hydrocarbon production from non-traditional types of deposits in the world.		
9	Theme 9. Environmental aspects of prospecting, exploration and development of shale gas (oil) and gas tight reservoirs. Environmental risk assessment.	4	4
10	Theme 10. Environmental aspects of exploration and development of gas fields of coal basins. Evaluation of environmental differences.	2	6
	Control work #3		2
	Total	28	60

Total hours of the discipline – 90, that include:

Lectures – **28 hrs**

Consultations - **2 hrs**

Self-studying work - **60 hrs**

RECOMMENDED LITERATURE:

Basic:

1. Карпенко О.М., Крочак М.Д., Байсарович І.М. Актуальні проблеми нафтогазової геології. К., 2017. 101 с.
2. Михайлов В.А., Карпенко О.М., Огар В.В. Нафта і газ сланцевих порід, ущільнених колекторів, метан вугільних басейнів. Навчальний посібник. К.: «Ніка-Центр», 2015. – 374 с.
3. Нетрадиційні джерела вуглеводнів України. Кн. I. Нетрадиційні джерела вуглеводнів: огляд проблеми / Куровець І.М., Михайлов В.А., Зейкан О.Ю. та ін. – К.: Ніка-центр, 2014. – 210 с.
4. Нетрадиційні джерела вуглеводнів України. Кн. II. Західний нафтогазоносний регіон / Крупський Ю.З., Куровець І.М., Сеньковський Ю.М. та ін. – К.: Ніка-центр, 2014. – 400 с.
5. Нетрадиційні джерела вуглеводнів України. Кн. III. Південний нафтогазоносний регіон / Михайлов В.А., Куровець І.М., Сеньковський Ю.Н., Вижва С.А., Григорчук К.Г., Загнітко В.М., Гнідець В.П., Карпенко О.М., Куровець С.С. – К.: ВПЦ «Київський університет», 2014. – 222 с.
6. Нетрадиційні джерела вуглеводнів України. Кн. IV. Східний нафтогазоносний регіон: аналітичні дослідження / Михайлов В.А., Вижва С.А., Загнітко В.М., В.В. Огар, О.М. Карпенко та ін. – К.: ВПЦ «Київський університет», 2014. – 484 с.
7. Нетрадиційні джерела вуглеводнів України. Кн. VII. Метан вугільних родовищ, газогідрати, імпакті структури і накладені западини Українського щита / Михайлов В.А., Зейкан О.Ю., Коваль А.М. та ін. – К.: Ніка-центр, 2013. – 368 с.
8. Dyni J. R. Geology and Resources of Some World Oil-Shale Deposits Scientific. U.S. Geological Survey, Reston, Investigations Report 2005–5294. Virginia, 2006. 1-42.
9. From Oil-Prone Source Rock to Gas-Producing Shale Reservoir – Geologic and Petrophysical Characterization of Unconventional Shale-Gas Reservoirs / Q. R. Passey, K. M. Bohacs, W. L. Esch, R. Klimentidis, and S. Sinha. ExxonMobil Upstream Research Co. Copyright 2010, Society of Petroleum Engineers. 1-29.
10. Fellous Jean-Lous, Gautier Catherine. Les gaz de schiste. Nouvel Eldorado ou impasse? ODILE Jacob, Paris, 2013
11. Gordon D. Understanding Unconventional Oil // Energy and Climate, 2012. - P. 1-25.
12. Mineralogy and facies variations of Devonian and Carboniferous shales in the Ukrainian Dniepr-Donets Basin / David MISCH, Eva WEGERER, Doris GROSS, Reinhard F. SACHSENHOFER, Alessandra RACHETTI, Reinhard GRATZER. . Austrian Journal of Earth Sciences. Volume 111/1. 2018. 15-25.
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13. Simenson, A.L. Depositional facies and petrophysical analysis of the Bakken Formation, Parshall field and surrounding area, Mountrail County, in North Dakota. Rocky Mountain Association of Geologists publication. The Bakken-Three Forks Petroleum System in the Williston Basin, 2011 / A.L.Simenson, S.A.Sonnenberg, R.M.Cluff // pp. 48–101. <https://core.ac.uk/download/pdf/230456658.pdf>
14. Steptoe Anne Petrofacies and Depositional Systems of the Bakken Formation in the Williston Basin, North Dakota. Graduate Theses, Dissertations, and Problem Reports. 3524. 2012. <https://researchrepository.wvu.edu/etd/3524>
15. Tissot B.P., Welte D.H. Petroleum Formation and Occurrence. 2nd Edition, Springer-Verlag, Berlin. 1984. 1-699.
16. Van Krevelen D.W. Coal. Elsevier science, 1993. Vol. 3. 514 p. https://openlibrary.org/books/OL1147163M/Coal--typology_physics_chemistry_constitution

Additional:

1. An unconventional gas future for the Donets coal basin / V. Pryvalov, R. Sachsenhofer, O. Panova, A. Izart. Геолог України, 2. 2012. 152-157. https://www.academia.edu/51232446/An_unconventional_gas_future_for_the_Donets_coal_basin
2. Karpenko O., Mykhailov V., Baysarovych I. Location of gas-saturated objects of unconventional types in the well sections by the well-logging data. Monitoring 2019 Conference - «Monitoring of Geological Processes and Ecological Condition of the Environment». 2019. – Kyiv.
3. Karpenko O., Ohar V., Karpenko I. Total Organic Carbon and Gamma Radioactivity Distribution of the Rudov Beds Formation within the Area Adjusted to Yablunivske O&G Field (Dnieper-Donets Basin). XIX міжнар. наук. конф. "Геоінформатика: Теоретичні та прикладні аспекти", (Київ, 2020).
4. Karpenko O., Ohar V.V., Karpenko I.O., Bezrodna I.M. Differentiation of Rudov Beds based on the statistical methods on geological and geophysical data. Науковий вісник НГУ. Дніпропетровськ, 2021. - № 1(181). – С. 5-10.
5. Zeng, W., Song, Z. Influences of Clay Mineral and Organic Matter on Nanoscale Pore Structures of the Cretaceous Lacustrine Shales in the Songliao Basin, Northeast China. Energies 2022, 15, 7075. <https://doi.org/10.3390/en15197075>

ADDITION №1

to the working program of the academic discipline: «GEOLOGY AND UNCONVENTIONAL HYDROCARBONS RESEARCH»

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>2</i>
Number of credits ECTS	<i>3</i>
Number of people	<i>5</i>

STRUCTURE OF THE DISCIPLINE PLAN OF LECTURES AND INDEPENDENT LESSONS

#	Theme	Hours	
		Lectures	Self – studying work
<i>Chapter 1. Basic information about hydrocarbon deposits associated with shale formations, coal deposits, and tight reservoirs</i>			
1	Introduction Theme 1. Unconventional hydrocarbons: origin and classification	4/6*	4/6*
2	Theme 2. Shale oil and gas. Gas deposits in compacted collectors.	4/6*	4/6*
3	Theme 3. Methane of coal basins.	6/6*	6/6*
4	Theme 4. Geological and geographical features of the distribution of hydrocarbon deposits of unconventional type.	6/8*	6/8*
	<i>Control work #1</i>	2/2*	2/2*
<i>Chapter 2 Methods of research and assessment of the resource base of hydrocarbons of unconventional fields / deposits. Petrographic and petrophysical features of gas shale and compacted reservoirs</i>			
5	Theme 5. Petrographic and petrophysical features of reservoir rocks of unconventional type hydrocarbon deposits. Geophysical methods of diagnostics of hydrocarbon deposits of unconventional type.	4/6*	4/6*
6	Theme 6. Methods of estimating resources and reserves of hydrocarbons of unconventional fields / deposits.	4/6*	4/6*
7	Theme 7. Peculiarities of the development of hydrocarbon deposits of unconventional type. Methods of control over the development of deposits.	6/8*	6/8*
	<i>Control work #2</i>	2/2*	2/2*
<i>Chapter 3 Environmental aspects of exploration, study and development of unconventional hydrocarbon deposits</i>			
8	Theme 8. General ecological, social and political consequences of increasing the resource base and volumes of hydrocarbon production from non-traditional types of deposits in the world.	4/2*	6/6*

9	Theme 9. Environmental aspects of prospecting, exploration and development of shale gas (oil) and gas tight reservoirs. Environmental risk assessment.	4/2*	6/6*
10	Theme 10. Environmental aspects of exploration and development of gas fields of coal basins. Evaluation of environmental differences.	2/1*	6/8*
	<i>Control work #3</i>		2/2*
	Total	28/17*	60/72*

Total hours of the discipline – 90, that include:

Lectures – **28 hrs/17*hrs**

Consultations - **2 hrs/3* hrs**

Self-studying work - **60 hrs/72* hrs**