

Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Ястребов Олег Александрович
Должность: Ректор
Дата подписания: 25.05.2026 15:07:48
Уникальный программный ключ:
ca953a0120d891083f939673078ef1a989dae18a

**Federal State Autonomous Educational Institution of Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba
RUDN University**

Academy of Engineering

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

**Current development of the production of unconventional hydrocarbon resources in
the world / Современное развитие добычи нетрадиционных ресурсов**

УГЛЕВОДОРОДОВ В МИРЕ

course title

Recommended by the Didactic Council for the Education Field of:

21.04.01 Oil and Gas Engineering

field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of
higher education:**

Oil and Gas Engineering / Технологии добычи и транспортировки нефти и газа

higher education programme profile/specialisation title

1. COURSE GOAL(s)

The discipline «Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире» is included in the curriculum of the master's programme "Oil and Gas Engineering / Технологии добычи и транспортировки нефти и газа" within the field of study 21.04.01 "Oil and Gas Engineering" and is studied in the 3rd semester of master 2. The discipline is delivered by the Department of Mineral Developing and Oil & Gas Engineering. It consists of 3 sections and 11 topics and is aimed at understanding the concept of "unconventional hydrocarbon sources" and the economic benefits of their use, equipping students with knowledge of the characteristics and features of unconventional hydrocarbon sources, advanced methods of their use, challenges and prospects for the development of unconventional hydrocarbon resources, and mastering methods for assessing their efficiency.

The goal of the discipline is to provide students with knowledge, skills, competencies, and practical experience in acquiring theoretical and practical skills, as well as mastering innovative technologies unconventional hydrocarbon for the production by mining, underground, and from wells.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире" is designed for students to acquire following competences (competences in part):

Table 2.1. List of competences that students acquire during the course

Competence code	Competence descriptor	Competence formation indicators (within this course)
PC-1	Able to use theoretical knowledge in the implementation of technological scientific research in the field of development, transportation and processing of oil and gas	<p>PC-1.1. Knows fundamental concepts in the field of geology of oil and gas fields, methods of forecasting, prospecting and exploration of mineral deposits; regulatory and methodological documents in the field of hydrocarbon production and development of oil and gas fields.</p> <p>PC-1.2. Able to use theoretical knowledge and geological information to perform technological scientific research, as well as apply knowledge of regulatory and methodological documents for the assessment of oil and gas fields.</p> <p>PC-1.3. Possesses theoretical knowledge, methods of subsoil research in the field of oil and gas field development; skills for performing production, technological and engineering research in the field of hydrocarbon production, oil and gas field development.</p>
PC-4	Able to draw up technical documentation for the implementation of the technological process (work schedules, instructions, plans, estimates, requests for materials, equipment, etc.), make an economic assessment of oil and gas fields in	<p>PC-4.1. Knows the requirements and GOSTs for the preparation of technical documentation, basic methods of geological and industrial assessment of oil and gas fields; methods of geological-industrial and geological-economic assessment (GEO) of new geological exploration projects, taking into account all the uncertainties and risks of their implementation.</p> <p>PC-4.2. Can draw up and draw up technical documentation for the implementation of technological processes in the</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
	accordance with approved forms	field of oil and gas field development, transportation and processing of oil and oil products; apply new methods of geological and industrial evaluation of oil and gas fields; determine the geological resources and the probability of finding a deposit, its production potential; carry out planning and evaluation of infrastructure solutions; determination of costs for the discovery and development of a field. PC-4.3. Has the methodology for preparing primary reporting, including work schedules, instructions, plans, estimates, applications for materials, equipment according to approved forms.

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the elective component of (B1) block of the higher educational programme curriculum.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
PC-1	Able to use theoretical knowledge in the implementation of technological scientific research in the field of development, transportation and processing of oil and gas	Geoinformation Systems and Applications; Current development of the production of unconventional hydrocarbon resources in the world; Advanced oil and gas processing equipment and product quality management; Innovative technologies for the transportation and storage of hydrocarbons; Base component (practices); Research work (obtaining primary skills in research work)	Pre-graduation Practical Training; State Exam; Graduate Qualification Work
PC-4	Able to draw up technical documentation for the implementation of the technological process (work schedules, instructions, plans, estimates, requests for materials, equipment, etc.), make an economic assessment of oil and gas fields in accordance with approved forms	Modern aspects of geological and geophysical research in the oil and gas industry; Technologies for developing prospective hydrocarbon reserves; Well repair and water breakthrough control technologies; Modern stream in oil and gas processing in Russia; Advanced oil and gas processing equipment and product quality management; Innovative technologies for	Pre-graduation Practical Training; State Exam; Graduate Qualification Work

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
		the development of hydrocarbon deposits; Innovative technologies for the transportation and storage of hydrocarbons; Technological practice (educational); Technological practice (industrial)	

* To be filled in according to the competence matrix of the higher education programme

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course "Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире" is 5 credits.

Table 4.1 Types of academic activities during the period of the HE programme mastering

Type of study work	TOTAL, acc.hrs.	Semester(s) 3
<i>Contact academic hours, acc .</i>	54	54
including:		
Lectures	18	18
Laboratory work		
Seminars (workshops/tutorials)	36	36
<i>Self-study (ies), academic hours</i>	99	99
<i>Evaluation and assessment (exam or pass/fail grading)</i>	27	27
The course total workload	acc.hrs.	180
	Credits	5

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course topic title	Course module contents (topics)	Academic activities types
1 Types of Hydrocarbon Raw Materials and Their Sources	1.1	Introduction to the concept of "unconventional hydrocarbon resources," classification approaches.	LC, S
	1.2	Stages of studying unconventional sources of gas and oil raw materials, development of demand for unconventional hydrocarbon resources.	LC, S

		1.3	Assessment of unconventional hydrocarbon resources in Russia and the world. Economic incentives for developing these fields.	Global reserves of shale gas, oil, bitumens, gas hydrates. Leading regions (USA, Canada, Argentina, China). Russian resource base (Bazhenov Formation, Domanik, coalbed methane). Tax incentives (mineral extraction tax, export duties), public-private partnership mechanisms.	LC, S
2	Unconventional Gas Resources	2.1	Gas hydrates.	Crystalline compounds of water and gas (methane). Formation conditions (low temperatures, high pressure). Geographical distribution (seabeds, permafrost zones). Extraction methods: depressurization, thermal stimulation, inhibitors. Challenges and prospects for industrial development.	LC, S
		2.2	Coalbed methane.	Sorbed gas in coal seams. Degasification technology: hydraulic fracturing, reservoir pressure drawdown. Key parameters (permeability, gas content). Global projects (USA, Australia, China). Russian experience (Kuzbass). Environmental risks (aquifers).	LC, S
		2.3	Shale gas.	Gas contained in low-permeability clay shales. Technological complex: horizontal drilling + multistage hydraulic fracturing (HF). Characteristics of major basins (Marcellus, Barnett, Haynesville – USA). Environmental debates: groundwater contamination, seismicity, water consumption. Potential in Russia.	LC, S
		2.4	Gas from tight reservoirs and water-dissolved gas.	Gas from tight sandstones and carbonates – low porosity and permeability. Stimulation methods (hydraulic fracturing, acid treatments). Water-dissolved gas – gas dissolved in underground water. Production specifics (high water influx, low flow rates). Field examples.	LC, S
3	Unconventional Oil Resources	3.1	Oil from low-permeability reservoirs.	Oil deposits in tight rocks (tight oil). Analogy with shale gas: horizontal wells, multistage hydraulic fracturing. Typical reservoirs: carbonates, siltstones. Largest formations (Bakken, Eagle Ford – USA; Bazhenov – Russia). Problems of rapid production decline and low recovery factor.	LC, S
		3.2	Heavy and extra-heavy oils.	Oils with high density and viscosity. Difference from light oils: high content of resins, asphaltenes, metals (V, Ni). Extraction methods: cyclic steam stimulation, steam-assisted gravity drainage (SAGD), in-situ combustion. Major fields (Orinoco Belt – Venezuela, Athabasca oil sands – Canada).	LC, S
		3.3	Natural bitumens, oil sands.	Solid or viscous hydrocarbons mixed with sand and clay. Open-pit (surface) and underground (shaft) mining. Bitumen extraction using hot water (Clark method) or solvents. Industrial centers: Canada (Athabasca), Venezuela (Orinoco), Russia (Yaregskoye, Osinskoye fields).	LC, S

			Environmental consequences (tailings ponds, CO ₂ emissions).	
	3.4	Synthetic oil from kerogen-containing rocks.	Kerogen – insoluble organic matter in oil shale. Conversion technologies: pyrolysis (retorts), hydrolysis, in-situ gasification. Products – synthetic oil (syncrude) and gas. Major projects (Estonia, Brazil, China). Economic barriers.	LC, S

* - to be filled in only for **full**-time training: *LC* - lectures; *LW* - lab work; *S* - seminars.

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture	A lecture hall for lecture-type classes, equipped with a set of specialised furniture; board (screen) and technical means of multimedia presentations.	
Seminar	A classroom for conducting seminars, group and individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and technical means for multimedia presentations.	
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Tetelmin, V. V., Yazev, V. A., Solovyanov, A. A. Shale hydrocarbons. Production technologies. Environmental threats: textbook. – Dolgoprudny: Intellect, 2014. – 296 p.
2. Vorobyev, A. E., Malyukov, V. P. Gas hydrates. Technologies for influencing unconventional hydrocarbons: textbook. – Moscow: RUDN University Publishing House, 2007. – 273 p. : ill.

Additional(optional) reading (sources):

3. Ganieva, T. F., Polovnyak, V. K. High-viscosity oils, natural bitumens and bituminous rocks [Electronic resource]: textbook. – Electronic data. – Kazan: KNRTU, 2012.
4. Unconventional and renewable energy sources: textbook / compiled by I. Yu. Chuenkova; North Caucasus Federal University. – Stavropol: North Caucasus Federal

University (NCFU), 2015. – 148 p.

5. Ignatova, K. P., Malyukov, V. P. Innovative technology of thermal gas stimulation of unconventional hydrocarbons of hard-to-recover reserves of the Bazhenov Formation: monograph. – Electronic text data. – Moscow: RUDN University, 2013. – 147 p.

Internet sources

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) <http://lib.rudn.ru/MegaPro/Web>
- EL "University Library Online" <http://www.biblioclub.ru>
- EL "Yurayt" <http://www.biblio-online.ru>
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" <http://e.lanbook.com/>

2. Databases and search engines:

- electronic foundation of legal and normative-technical documentation <http://docs.cntd.ru/>
- Yandex search engine <https://www.yandex.ru/>
- Google search engine <https://www.google.ru/>
- Scopus abstract database <http://www.elsevier.com/locate/scopus/>

*Training toolkit for self- studies to master the course *:*

1. The set of lectures on the course «Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире».

2. Guidelines for students on the development of the course "Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире".

*The training toolkit and guidelines for the course are placed on the course page in the university telecommunication training and information system under the set procedure.

DEVELOPERS:

Associate Professor of the Department of Mineral
Developing and Oil&Gas Engineering

Tcharo H.

position, department

name and surname

HEAD OF EDUCATIONAL DEPARTMENT:

Mineral Developing and Oil&Gas Engineering

Kotelnikov A.E.

name of department

name and surname

HEAD**OF HIGHER EDUCATION PROGRAMME:**

Professor of the Department of Mineral Developing and
Oil&Gas Engineering

Kapustin V.M.

position, department

name and surname