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**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

**Innovative technologies for the transportation and storage of hydrocarbons /
Инновационные технологии транспортировки и хранения углеводородов**

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 goal of the course "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" is to equip students with theoretical knowledge and practical skills in solving complex issues related to the use of software and equipment for well operation and efficient field development. Teaching students to identify problems and select intellectual and technical developments for the conditions of various fields. General information about the application of the latest technologies and developments in the field of data collection and processing, as well as adjustments and changes in operating modes during well operation and in general during field development.

The aims of the course are:

- study of the methodology for identifying problems in the field development and well operation;
- study of existing intellectual Russian and foreign developments;
- acquiring the skills of choosing one or another equipment;
- mastering the methodology for calculating the characteristics of equipment.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" 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 and transportation 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-3	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	<p>PC-3.1. Knows the principles, physical foundations, technical support of technical control and diagnostic methods, modern developments in the field of strength of materials, fracture mechanics, materials technology and materials science; design features, manufacturing technology, operation and repair of the control object, types and types of defects, probable zones of their formation, taking into account the loads acting on the object and other factors, principles, physical foundations, technical support for the types and methods of technical control and diagnostics; principles of construction, functional diagrams</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p>and rules for operating equipment for a given method of control, rules for selecting and checking the quality of used consumable flaw detection materials; control systems used to check objects (products) of a certain type; metrological support; standards, calculation methods and other applicable regulatory documents and rules for assessing the technical condition; harmful environmental factors of this control method and ways to prevent their impact on the environment and humans; principles of planning and organization of work of technical control and diagnostic units, current state and prospects for the development of technical control and diagnostic methods; rules for electrical safety and fire safety, rules for the construction and safe operation of facilities.</p> <p>PC-3.2. Can determine the methods, equipment, technologies and techniques to be used for specific types of objects; perform control operations, evaluate and identify the results of control and testing, issue conclusions on the results of technical control and diagnostics; organize, conduct and manage calculations and experimental work to assess the technical condition.</p> <p>PC-3.3. Has the skills to perform verification calculations, taking into account the identified defects; assessment of the mutual influence of various defects on the technical condition of the control object; determining the need for additional research in order to clarify the determining parameters of the technical condition; development of measures to reduce operational risks based on risk analysis, minimization of operational risks.</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 accordance with approved forms	<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 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.</p> <p>PC-4.3. Has the methodology for preparing primary reporting, including work schedules, instructions, plans, estimates, applications for materials, equipment according to approved forms.</p>

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the variable 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 and transportation 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; Comprehensive analysis of processing, storage and marketing of hydrocarbons; Research work (obtaining primary skills in research work)	Pre-graduation Practical Training; State Exam; Graduate Qualification Work
PC-3	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	Machinery and equipment for field development and transportation of hydrocarbons; Fundamentals of construction and operation of pipeline transport; Methods for oil production intensification and enhanced oil recovery; Advanced oil and gas processing equipment and product quality management; Base component (practices); Technological practice (educational); Technological practice (industrial)	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; Base component (practices); Technological practice	Pre-graduation Practical Training; State Exam; Graduate Qualification Work

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
		(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 "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" 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>	36	36
including:	18	18
Lectures		
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 Mining-geological and technical conditions for construction of underground gas and oil storage facilities	1.1 Rock salt deposits suitable for construction of underground reservoirs. Possibility of storing hydrocarbons in underground reservoirs	Description and classification of rock salt deposits suitable for construction of underground reservoirs. Assessment of the possibility of storing hydrocarbons in underground reservoirs	LC, S
	1.2 Utilization, discharge and storage of brine obtained during construction of underground reservoirs in rock salt	Review and analysis of best practices for utilization, discharge and storage of brine obtained during construction of underground reservoirs in rock salt	LC, S

		1.3	Storage of technological brine reserve for operation of underground reservoirs in rock salt	Analysis of best technologies for storing technological brine reserve for operation of underground reservoirs in rock salt	LC, S
2	Design and construction of underground hydrocarbon storage facilities in rock salt	2.1	Classification of underground storage facilities and conditions for their application. Technological complex for operation of underground storage facilities in rock salt	Study of classification criteria for underground storage facilities and conditions for their application. Description of the technological complex for operation of underground storage facilities in rock salt	LC, S
		2.2	Calculation of minimum backpressure and maximum span of a cavity in rock salt	Performing calculations of minimum backpressure and maximum span of a cavity in rock salt	LC, S
3	Construction technology of underground cavities in rock salt	3.1	Technological schemes for construction of underground reservoirs in rock salt	Description and analysis of technological schemes for construction of underground reservoirs in rock salt	LC, S
4	Main indicators of underground storage facilities in rock salt	4.1	Underground storage facilities in Russia and CIS countries	Study of main underground storage facilities in Russia and CIS countries	LC, S
		4.2	Underground hydrocarbon storage facilities in foreign countries	Overview of main underground hydrocarbon storage facilities in foreign countries	LC, S
		4.3	New directions of underground storage of raw materials in rocks	Description of new directions of underground storage of raw materials in rocks	LC, S

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. Innovative technologies for underground gas storage in depleted gas fields [Text]: Monograph / A.E. Vorobyov, V.P. Malyukov - M. : Publishing House of RUDN University, 2009. - 103 p.

2. Pipeline transport and storage of hydrocarbon resources: examples of solving typical problems: textbook: in 2 volumes / A.A. Gladenko, S.M. Chekardovsky, S.Yu. Podorozhnikov and others; ed. Yu.D. Zemenkov; Ministry of Education and Science of Russia, Omsk State Technical University, Tyumen Industrial University. - Omsk: OmGTU Publishing House, 2017. - T. 2. - 352 p. : tab., graph., ill. - Bibliography: p. 367-391 - ISBN 978-5-8149-2550-3. - ISBN 978-5-8149-2552-7 (vol. 2); <http://biblioclub.ru/index.php?page=book&id=493447>

Additional(optional) reading (sources):

1. Innovative technologies for reserving hydrocarbons in underground workings-tanks [Text]: Textbook for universities / A.E. Vorobyov, V.P. Malyukov. - M. : Publishing House of RUDN University, 2007. - 84 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.elsevierscience.ru/products/scopus/>

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

1. The set of lectures on the course Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов.

2. Guidelines for students on the development of the course Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов.

*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.

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