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Информация о владельце:  
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Должность: Ректор  
Дата подписания: 16.05.2025 12:21:05  
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**

**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 GOALS

The goal of the course "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" is the mastering of theoretical and practical knowledge by undergraduates necessary for the implementation of production, technological and design activities that ensure the modernization, implementation and operation of equipment for storing oil and gas.

The study of the course "Innovative technologies for underground storage of hydrocarbons" provides for the formation of knowledge about the calculations of the capacity of the tank farm of the oil depot, losses when filling transport tanks, losses when oil flows out of tanks, the safety of tanks, oil depots and equipment, the reliability and efficiency of the operation of all structures of oil depots and gas storage facilities, development and rules for the implementation of measures to reduce oil losses, save fuel and materials, organize timely maintenance and repair of oil depots and gas storage facilities, environmental safety of facilities, construction of tank farms, terminals and gas storage facilities included in their complexes and equipment, repair of tank farms, terminals and gas storage facilities, the application of acquired knowledge, skills and abilities in subsequent professional activities.

## 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)
SPC-1	Able to use theoretical knowledge when performing technological scientific research in the field of development, transportation and processing of oil and gas	SPC-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 SPC-1.2 Can use theoretical knowledge and mining and geological information to carry out technological scientific research, as well as apply knowledge of regulatory and methodological documents to assess oil and gas fields SPC-1.3 Has the theoretical knowledge, methods of subsurface research in the field of oil and gas field development; skills to perform production, technological and engineering research in the field of hydrocarbon production, development of oil and gas fields
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	SPC-4.1 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 and rules for operating equipment for a given method of control, rules for selecting and checking the quality of used consumable flaw detection

		<p>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>SPC-4.2 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>SPC-4.3 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>
SPC-5	<p>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>	<p>SPC-5.1 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>SPC-5.2 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>SPC-5.3 Has the methodology for preparing primary reporting, including work schedules, instructions, plans, estimates, applications for materials, equipment according to approved forms</p>

### 3. ACADEMIC 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 that contribute to the achievement of the expected learning outcomes as the course results*

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
SPC-1	Able to use theoretical knowledge when performing technological scientific research in the field of development, transportation and processing of oil and gas	<i>Advanced oil and gas processing equipment and product quality management**;</i> Geoinformation Systems and Applications;	Research Work; Pre-graduation Practical Training;
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	<i>Advanced oil and gas processing equipment and product quality management**;</i> <i>Fundamentals of construction and operation of pipeline transport;</i> <i>Machinery and equipment for field development and transportation of hydrocarbons;</i> <i>Technological practice (educational) / Технологическая практика (учебная);</i> <i>Technological practice (industrial) / Технологическая практика (производственная);</i>	Pre-graduation Practical Training;
SPC-5	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	<i>Advanced oil and gas processing equipment and product quality management**;</i> <i>Modern aspects of geological and geophysical research in the oil and gas industry;</i> <i>Modern stream in oil and gas processing in Russia**;</i> <i>Technologies for developing prospective hydrocarbon reserves;</i> <i>Technological practice (educational) / Технологическая практика (учебная);</i> <i>Technological practice (industrial) / Технологическая практика (производственная);</i>	Pre-graduation Practical Training;

\* - filled in in accordance with the matrix of competencies and Higher Education Programme

#### 4. COURSE WORKLOAD

The total workload of the course "Innovative technologies for the transportation and

storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" is 4 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>		63	63
<i>Evaluation and assessment (exam or pass/fail grading)</i>		27	27
<b>The course total workload</b>	acc.hrs.	<b>144</b>	<b>144</b>
	credits	<b>4</b>	<b>4</b>

## 5.COURSE MODULE and CONTENTS

*Table 5.1. The content of the discipline (module) by type of educational work*

Name of the section (topic) of the discipline	Contents of the section (topic)	Type of study work
Section 1. Mining-geological and technical conditions for the construction of underground gas and oil storage facilities	Topic 1.1. Rock salt deposits suitable for the construction of underground reservoirs. Possibility to store hydrocarbons in underground reservoirs	Lecture, Lab work
	Topic 1.2. Utilization, discharge and storage of brine obtained during the construction of underground reservoirs in rock salt	
	Topic 1.3. Storage of a technological reserve of brine for the operation of underground reservoirs in rock salt	
Section 2. Design and installation of underground storages of hydrocarbons in rock salt	Topic 2.1. Classification of underground storage facilities and conditions for their use. Technological complex for exploitation of underground storages in rock salt	Lecture, Lab work
	Topic 2.2. Calculation of the minimum backpressure and the maximum span of a working-capacity in rock salt	Lecture, Lab work
Section 3. Technology for the construction of underground workings of tanks in rock salt	Topic 3.1. Technological schemes for the construction of underground reservoirs in rock salt	Lecture, Lab work
Section 4. The main indicators of underground storages in rock salt	Topic 4.1. Underground storage facilities in Russia and CIS countries	Lecture, Lab work
	Topic 4.2. Underground hydrocarbon storage facilities in foreign countries	Lecture, Lab work
	Topic 4.3. New directions of underground storage of raw materials in rocks	Lecture, Lab work

## 6. CLASSROOM EQUIPMENT and TECHNOLOGY SUPPORT REQUIREMENTS

- *Table 6.1. Classroom Equipment and Technology Support Requirements*

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary)
Lecture	Training room for conducting lecture-type classes: room. No. 2030 A set of specialized furniture; interactive panel	
Seminar	Computer class No. 2033 Set of specialized furniture; PC, telepanel	
For self-study	Classroom for conducting seminar-type classes: room. No. 2037 Set of specialized furniture; chalkboard; projector, laptop	

## 7. RESOURCES RECOMMENDED FOR COURSE

### *Main reading(sources):*

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.

### *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.

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>

### *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](http://www.studentlibrary.ru)
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"

### *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](http://www.studentlibrary.ru)
- EL "Lan" <http://e.lanbook.com/>
- EL "Trinity Bridge"

### *Learning toolkits for self- studies:*

1. A course 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.

## **5. ASSESSMENT TOOLKIT AND GRADING SYSTEM\* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS COURSE RESULTS**

The assessment toolkit and the grading system\* to evaluate the level of competences (competences in part) formation as the course results are specified in the Appendix to the course syllabus.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

### **DEVELOPERS:**

Associate Professor of the Department of Mineral  
Developing and Oil&Gas Engineering  
\_\_\_\_\_  
position, educational department

Voronov G.A.  
\_\_\_\_\_  
name and surname

### **Head of Department:**

Head of the Department of Mineral Developing  
and Oil&Gas Engineering  
\_\_\_\_\_  
position, educational department

Kotelnikov A.E.  
\_\_\_\_\_  
name and surname

### **Head of Educational Programme:**

Professor of the Department of Mineral  
Developing and Oil&Gas Engineering  
\_\_\_\_\_  
position, educational department

Kapustin V.M.  
\_\_\_\_\_  
name and surname