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ФИО: Ястребов Олег Александрович
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**Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University
Academy of Engineering**

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

COURSE SYLLABUS OF THE DISCIPLINE

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

(name of discipline/module)

Recommended by the Didactic Council for the Education Field:

21.04.01 Oil and gas engineering

(code and name of the Higher Education Field)

The development of the discipline is carried out within the framework of the implementation of the higher education program of higher education (Higher Education Program):

Oil and gas engineering / Технологии добычи и транспортировки нефти и газа

(name (profile/specialization) of the Higher Education Program)

1. COURSE GOALS

The purpose of mastering the discipline "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 discipline "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. LEARNING OUTCOMES

Mastering the discipline "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" is aimed at developing the following competencies (parts of competencies) among students:

Table 2.1. The list of competencies formed by students in the course of mastering the discipline (the results of mastering the discipline)

Competence code	Competence	Competence indicators (within this discipline)
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	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

		<p>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>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. THE PLACE OF ACADEMIC PROGRAM STRUCTURE

The discipline "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" refers to the part formed by the participants in the educational relations of block B1 of the Higher Education Program.

As part of the Higher Education Program, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline “Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов”.

Table 3.1. The list of components of the Higher Education Program that contribute to the achievement of the planned results of the development of the discipline

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
SPC-1	Able to use theoretical knowledge when performing technological scientific research in the field of development, transportation and processing of oil and gas	Applications of Geoinformation Systems / Практикум применения геоинформационных систем	Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) Research work / Научно-исследовательская работа Pre-graduate practice / Преддипломная практика SFC
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	Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации трубопроводного транспорта	Technological practice (training) / Технологическая практика (учебная) Technological practice (production) / Технологическая практика (производственная) Pre-graduate practice / Преддипломная практика SFC
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	Modern aspects of geological and geophysical research in the oil and gas industry / Современные аспекты геолого-промысловых и геофизических исследований в нефтегазовом деле	Technological practice (training) / Технологическая практика (учебная) Technological practice (production) / Технологическая практика (производственная) Pre-graduate practice / Преддипломная практика SFC

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

4. COURSE WORKLOAD and ACADEMIC/TRAINING/LEARNING ACTIVITIES

The course total workload for the discipline "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" is equal to 4 credits.

Table 4.1. Types of academic activities during the period of the HE program mastering

Type of study work		TOTAL , acc.hrs.	Semester(s) 3
<i>Contact academic hours, acc .</i>		<i>54</i>	<i>54</i>
including:			
Lectures		18	18
Laboratory work			
Seminars (workshops/tutorials)		36	36
<i>Self-study (ies), academic hours</i>		<i>63</i>	<i>63</i>
<i>Evaluation and assessment (exam or pass fail grading)</i>		<i>27</i>	<i>27</i>
The course total workload	acc.hrs.	144	144
	credits	4	4

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

		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. 335 A set of specialized furniture; technical means: projection screen; multimedia projector SANYO PROtraX ; system block DEPO Neos 220	
Seminar	Classroom for conducting seminar-type classes: room. No. 356 A set of specialized furniture; chalk board; monitor NEC PLASMA MONITO MODEL PX-42XM1G; system block DEPO Neos 220	
For self-study	Classroom for conducting seminar-type classes: room. No. 356 A set of specialized furniture; chalk board; monitor NEC PLASMA MONITO MODEL PX-42XM1G; system block DEPO Neos 220	

7. RECOMMENDED SOURCES for COURSE STUDIES

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-(based) sources:

1. Electronic libraries with access for RUDN students:

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

- EBS "Trinity Bridge"

2. Databases and search engines:

- electronic fund of legal and normative-technical documentation <http://docs.cntd.ru/>- Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)- Google search engine <https://www.google.ru/>- abstract database SCOPUS [http:// www .elsevier.com/ products / scopus /](http://www.elsevier.com/locate/scopus/)*Learning toolkits for self- studies in the RUDN LMS TUIS:*

1. Guidelines for students on mastering the discipline "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов."

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline **in TUIS!****8.ASSESSMENT AND EVALUATION TOOLKIT**

Marking criteria (MC) and a 100-point (score) scale for assessing the level of competencies (part of competencies) based on the results of mastering the discipline "Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов" are presented in the Appendix to this Work Program of the discipline.

* - MC and 100-point (score) are formed on the basis of the requirements of the relevant local normative act of the Peoples' Friendship University of Russia.

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

Position, Department



Signature

Malyukov V.P.

Full name

Head of Department:Director of the Department of Mineral
Developing and Oil&Gas Engineering

Name of Department



Signature

Kotelnikov A.E.

Full name

Head of Educational Programme:Professor of the Department of Mineral
Developing and Oil&Gas Engineering

Position, Department



Signature

Kapustin V.M.

Full name