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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

Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта 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)

2022

1. COURSE GOALS

The purpose of mastering the discipline "Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов" is to familiarize students with the device, block diagram, design of equipment used in the development of oil and gas fields, as well as in the transport and storage of oil and gas.

The aims of the course are:

- study of the purpose of a complex of machines and equipment for drilling wells, production, well repair, oil and gas transportation through main pipelines;
- study of the design of machines and equipment for drilling wells, production, well repair, oil and gas transportation through main pipelines;
- studying the issues of installation, operation, maintenance and repair of machines and equipment for drilling wells, production, well repair, oil and gas transportation through main pipelines.

2. LEARNING OUTCOMES

Mastering the discipline " Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов " is aimed at developing the following competencies (parts of competencies):

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)
GPC-2	Able to design oil and gas production facilities	GPC-2.1. Knows the normative legal documents regulating the requirements for professional activity; algorithm for organizing work in the process of designing oil and gas production facilities; aspects of working in contact with the supervisor.
		GPC-2.2. Can apply the methods and technology of designing the main and additional processes of oil and gas production; formulate goals for the performance of work and propose ways to achieve them; own the methodology and technology for designing oil and gas production facilities; apply an activity approach to design problems in the field of oil and gas production; evaluate the convergence of the results of calculations obtained by various methods.
		GPC-2.3. Has the principles and techniques of designing oil and gas production facilities; methods for developing a scientific and methodological approach to the design of oil and gas production processes; has the skills to promptly fulfill the requirements of the working project; the skills to work in modern PCs, using new methods and software packages.
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of	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

Competence code	Competence	Competence indicators (within this discipline)
	the oil and gas complex	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 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
		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
		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
SPC-6	Capable of applying the basic principles of rational use of natural resources and environmental protection	SPC-6.1 Knows the legal and methodological framework of the procedure for conducting environmental impact assessment EIA and environmental expert activities for use in professional activities; fundamentals of the theory and normative legal acts of the integrated development and rational use of natural resources and environmental protection; the procedure for conducting a geological examination of projects, regulatory documents for compiling an environmental passport
		SPC-6.2 Can assess the state of the environment when conducting complex geological and geographical studies; use mechanisms for the rational use of natural resources and environmental protection; apply regulatory and methodological documents to assess and prevent environmental damage at production facilities
		SPC-6.3 Has the methodology of rational use of natural resources and environmental protection; a system of methods (EIA) and conducting state environmental expertise for successful research and production activities; skills and knowledge to assess environmental damage at production facilities, modern methods for eliminating the

Competence code	Competence	Competence indicators (within this discipline)
		consequences and preventing environmental damage at production facilities
SPC-7	Able to organize, manage, and carry out quality control of the main types of work in the development of oil and gas fields, transportation and processing of oil and gas	SPC-7.1 Knows: The main types of applied systems for assessing the quality of geological types of work in the development of oil and gas fields, transportation and processing of oil and gas; ISO-9001 quality system, GKZ regulations and classification of oil and gas reserves Requirements of regulatory legal acts of the Russian Federation, local regulations, administrative documents and technical documentation in the field of hydrocarbon production Technological processes of hydrocarbon production Purpose, device and principle of operation of equipment for the extraction of hydrocarbon raw materials Physical and chemical properties of hydrocarbon raw materials, chemical reagents, the procedure and rules for their disposal Technological modes, well operation parameters Standards for technological losses of hydrocarbon raw materials during production in accordance with the accepted scheme and development technology The influence of various processes occurring in the reservoir on the productivity factor of a production well The procedure for measuring the productivity factor of a production well Methods for calculating the productivity factor and skin effect according to well surveys with recording the pressure recovery curve Purpose, device and principle of operation of equipment for mechanized production of hydrocarbon raw materials Standards, specifications, guidelines for the development and execution of technical documentation Types of emergencies during well operation, their causes and methods of prevention and elimination Structure, interaction of means of an automated process control system, telemechanics, automatic control systems for hydrocarbon production equipment, ways to control them Requirements for labor protection, industrial, fire and environmental safety
		SPC-7.2 Can: Organize and conduct quality control of work in the development of oil and gas fields, transportation and processing of oil and gas at different stages of the study of specific objects Evaluate the residual life of hydrocarbon production equipment Analyze inflow characteristics in a vertical, horizontal or multilateral well Predict the change in the inflow characteristics from the reservoir to the well, taking into account the reservoir operation mode Develop operating instructions for hydrocarbon production equipment

Competence code	Competence	Competence indicators (within this discipline)
		Control the operation of equipment for artificial lift of hydrocarbons Identify wells operating with deviations from the planned regime Conduct emergency drills with subordinate personnel according to the action plan for localization and elimination of accidents and incidents at hydrocarbon production facilities
		SPC-7.3 Has: The methodology for assessing the quality of all types of work in the development of oil and gas fields, transportation and processing of oil and gas at different stages of the study of specific objects Skills for organizing and monitoring the implementation of plans and tasks for the extraction of hydrocarbons Skills for operational management of production and monitoring compliance with hydrocarbon production technology Skills for monitoring compliance with the specified operating mode of well equipment, piping, oil and gas field pipelines, prefabricated pipelines, gas pipelines, pipelines, inhibitor pipelines in accordance with the requirements of the technological regulations of the installation, operating instructions and passports of equipment manufacturers Skills to analyze the dynamics of hydrocarbon production. Organization of providing jobs with up-to-date technological documentation Skills in organizing monitoring and control of the operation of the field and wells Skills of control and management of work on the preparation and maintenance of technical documentation of the unit Skills of control and management in the direction of compliance with the requirements of labor protection, industrial, fire and environmental safety in the unit Skills to control and manage the preparation of reports on the production of hydrocarbons
SPC-8	Able to manage the work on the diagnostic examination of the main oil pipelines (MOP) and the main oil product pipelines (MOPP) facilities	SPC-8.1 Knows: Methods for organizing work on in-line diagnostic inspection of the MOP and MOPP using in-line inspection devices Organizational and administrative documents, regulatory and methodological materials in the field of quality control of work on the diagnostic examination of the MOP and MOPP List of scientific and technical documentation, the use of which is associated with the performance of work on the diagnosis of MOP and MOPP objects The procedure for the formation of long-term development plans in the field of diagnostic work at the facilities of MOP and MOPP The procedure for the development of design, executive and operational documentation for the direction of activity Rules for working with specialized software systems Requirements for labor protection, industrial, fire and

Competence code	Competence	Competence indicators (within this discipline)
		environmental safety
		SPC-8.2 Can: Determine the scope and procedure for performing work on the diagnostic examination of the MOP and MOPP Assess the compliance of work performance with the requirements of the technological process for diagnosing objects of MOP and MOPP Determine the composition and sequence of preparatory work for non-destructive quality control of structural elements of objects and structures of MOP and MOPP, mechano -technological equipment and metal structures of MOP and MOPP tanks, technical devices, materials, products, parts, assemblies, welded joints Ensure the prevention and elimination of violations of the production process of diagnosing objects of MOP and MOPP by NDT methods Determine the procedure for performing work to identify defects based on the results of additional flaw detection control of MOP and MOPP objects, including internal ones, measurement and refinement of their parameters Analyze advanced domestic and foreign experience in the field of diagnosing MOP and MOPP objects Use specialized software products in the field of activity Comply with the requirements of industrial safety and labor protection at the facilities of MOP and MOPP
		SPC-8.3 Has: Skills in planning work on diagnosing MOP and MOPP objects Skills in managing work on processing the results of diagnosing objects of MOP and MOPP Skills for verification and approval of production documentation for the diagnosis and control of MOP and MOPP facilities Skills to control the regulatory and technical support of work on diagnosing objects of MOP and MOPP Skills to control data entry into specialized software systems, and their verification

3. ACADEMIC PROGRAM STRUCTURE

The discipline " Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов " refers to the Compulsory (Disciplines) Module of block B1of 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 " Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов ".

Table 3.1. List of Higher Education Program components / disciplines that contribute to expected learning training outcomes

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
GPC-2	Able to design oil and gas production facilities	Disciplines of the previous level of education	Technological practice (training) / Технологическая практика (учебная) Technological practice (production) / Технологическая практика (производственная) SFC
SPC-4	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and structures of the oil and gas complex	Disciplines of the previous level of education	Methods of oil production intensification / Методы интенсификации добычи нефти Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации трубопроводного транспорта Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов Diagnostics of oil and petroleum products main pipeline facilities / Диагностирование объектов магистральных трубопроводов нефти и нефтепродуктов Technological practice (training) / Технологическая практика (учебная) Technological practice (production) / Технологическая практика (производственная) Pre-graduate practice / Преддипломная практика SFC
SPC-6	Able to apply the basic principles of sustainable use of natural resources and environmental protection	Disciplines of the previous level of education	Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире Methods of oil production intensification / Методы интенсификации добычи нефти Technologies for developing prospective hydrocarbon reserves / Технологии разработки перспективных запасов углеводородов Technological practice (educational) Technological practice (industrial) SFC

Competence code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
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	Disciplines of the previous level of education	Methods of oil production intensification / Методы интенсификации добычи нефти Innovative technologies for the development of hydrocarbon deposits / Инновационные технологии разработки месторождений углеводородов Improving the efficiency of the production process and operation of equipment for the extraction of hydrocarbons / Повышение эффективности процесса добычи и работы оборудования по добыче углеводородного сырья Pre-graduate practice / Преддипломная практика SFC
SPC-8	Able to manage work on the diagnostic examination of objects of main oil pipelines (MN) and main oil product pipelines (MNPP)	Disciplines of the previous level of education	Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации трубопроводного транспорта Diagnostics of oil and petroleum products main pipeline facilities / Диагностирование объектов магистральных трубопроводов нефти и нефтепродуктов Pre-graduate practice / Преддипломная практика SFC

* - filled in in accordance with the matrix of competencies and CMS HEP HE

4. COURSE WORKLOAD and ACADEMIC/TRAINING/LEARNING ACTIVITIES

The total workload intensity of the discipline " Machines and equipment for the development of deposits and transport of hydrocarbons " is 7 credit units.

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

Type of study work		TOTAL, acc.	Semester(s)	
			one	2
Contact academic hours, acc .		*68*	*36*	*32*
including:				
Lectures		34	18	16
Laboratory work		-	-	-
Seminars (workshops/tutorials)		34	18	16
Self-study (ies), academic hours		*130*	*81*	*49*
Evaluation and assessment (exam or pass/fail grading)		*54*	*27*	*27*
The course total workload	acc.hrs.	**252**	**144**	**108**
	credits	**7**	**4**	**3**

5.COURSE MODULE and CONTENTS

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

Name of the discipline section	Contents of the section (topic)	Type of study work
Section 1. Machinery and equipment for the development of oil and gas fields	General information about machines and equipment for drilling oil and gas wells. Drilling rig traveling system. Purpose and composition. Drill winches. Brake devices for drilling winches. Drilling rotors. Drill keys. Drill swivels. Drive of drilling rigs. Power transfers. Couplings. The circulation system of the drilling rig. Blowout equipment. Hydro control units. Drill column. Drilling facilities. Fundamentals of calculation of drilling rigs. Hydraulic downhole motors. Turbodrills. Screw downhole motors. Electric drills. Pumping and cementing equipment. Casing piping equipment. Column heads.	Lecture, Lab work
	Pump and compressor pipes. Fundamentals of calculation of tubing. Equipment for the operation of flowing oil and gas wells. Shut-off and control devices for fountain fittings. Equipment for the operation of gas-lift wells. Equipment for the operation of wells in a mechanized way. Rod and rodless borehole pumping units. Equipment for the operation of wells in a mechanized way. Electric pumps with ground and submersible drive. Centrifugal electric pumps. Equipment for the operation of wells in a mechanized way. Electric pumps with ground and submersible drive. Screw and diaphragm electric pumps. Jet pumps.	Lecture, Lab work
	Equipment for separate and simultaneous-separate operation of wells. Equipment for separating the spaces of the production string. Packers. Downhole shut-off valves. Equipment for dehydration, desalination of oil and oil emulsion control. Separators, furnaces, electric dehydrators. Natural gas and condensate preparation system at the field. Adsorbers, absorbers. Underground well repair . Classification of equipment for well repair.	
	Equipment for tripping operations. Tool. Means of mechanization. Lifting equipment. Equipment for technological operations. Ground equipment. Equipment for technological operations. Equipment and tools lowered into the well. Equipment for the transport of oil and gas at pumping and compressor stations.	
Section 2. Machinery and equipment for transporting oil and gas	General information about transport and petroleum products. Pipeline transport. Pipeline route and its profile. Equipment for the transport of oil and gas at pumping and compressor stations, its purpose and composition, as well as the main technical characteristics.	Lecture, Lab work
	Reservoirs for storage of oil and oil products. Tank equipment. Classification and composition of natural and artificial gases. Compressor stations of gas pipelines. Removal of impurities from gas. Gas odorization	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 PROxtraX; 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	
Mining machine laboratory	No. 362 A set of specialized furniture; Drilling simulator "Transas SHELF 6000 Drill"; Additional trainee seat to the drilling simulator "Transas SHELF 6000 Drill"	TransasShelf 6000 DrillingSimulator software
Mining machine laboratory	No. 358 Computer with pre-installed licensed software "ARMARIS" Intel Coge15 processor; "Wellhead fittings" - mock-up stand; LED TV 3D on a stand with a screen diagonal of 32 inches; Model - controller "Elekton-09 1" from SU "Elekton 05-250" in a compact design	ARMARIS software for TESP ESP
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. Sharifullin, A.V. Structures and equipment for storage, transportation and distribution of petroleum products: study guide / A.V. Sharifullin, L.R. Baibekova, S.G. Smerdova; Ministry of Education and Science of the Russian Federation, State Educational Institution of Higher Professional Education "Kazan State Technological University". - Kazan: KSTU, 2011. - 135 p. : illustrations, tables, schemes. - Bibliography. in book. - ISBN 978-5-7882-0973-9;
http://biblioclub.ru/index.php?page=book&id=270290

2. Verzhbitsky, V.V. Fundamentals of the construction of oil and gas transport facilities: study guide / V.V. Verzhbitsky, Yu.N. Prachev; Ministry of Education and Science of the Russian Federation, Federal State Autonomous Educational Institution of Higher

Professional Education "North Caucasian Federal University". - Stavropol: NCFU, 2014. - 154 p.

http://biblioclub.ru/index.php?page=book&id=457777

Additional(optional) reading (sources):

1. Reservoirs for receiving, storing and dispensing petroleum products: study guide / Yu.N. Bezborodov, V.G. Shram, E.G. Kravtsova and others; Ministry of Education and Science of the Russian Federation, Siberian Federal University. - Krasnoyarsk: Siberian Federal University, 2015. - 110 p.

http://biblioclub.ru/index.php?page=book&id=435609

2. Technological equipment for gas stations and oil depots: study guide: At 2 hours / Yu.N. Bezborodov, O.N. Petrov, A.N. Sokolnikov, A.L. Feldman; Ministry of Education and Science of the Russian Federation, Siberian Federal University. - Krasnoyarsk: Siberian Federal University, 2015. - Part 2. Equipment for storing, receiving and dispensing petroleum products at oil depots and gas stations. - 172 p. :

http://biblioclub.ru/index.php?page=book&id=435655

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"
  - Electronic fund of legal and regulatory documents https://docs.cntd.ru/document/1200124394 (quality management system)

2. Databases and search engines:
- electronic fund of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https:// www .yandex.ru/
- Google search engine https://www.google.ru/
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

Learning toolkits for self- studies in the RUDN LMS TUIS:

1. A course of lectures on the discipline "Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов."
2. Guidelines for independent work of students in the discipline "Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов."
3. Guidelines for the implementation and execution of a term paper / project in the discipline "Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта 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 (parts of competencies) based on the results of mastering the discipline "Machinery and equipment for field development and transportation of hydrocarbons / Машины и оборудование для разработки месторождений и транспорта углеводородов" are presented in the Appendix to this Work Program of the discipline.

* - MC and the100-point (score) scale 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		Yushin E.S.
Position, Department	Signature	Full name

Head of Department: Director of the Department of Mineral Developing and Oil&Gas Engineering		Kotelnikov A.E.
Name of Department	Signature	Full name

Head of Educational Programme: Professor of the Department of Mineral Developing and Oil&Gas Engineering		Kapustin V.M.
Position, Department	Signature	Full name