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

Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России

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

2026

1. COURSE GOAL(s)

The discipline «Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России» 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 1st semester of master 1. The discipline is delivered by the Department of Mineral Developing and Oil & Gas Engineering. It consists of 5 sections and 10 topics and is aimed at studying the processes of deep chemical processing of hydrocarbon raw materials, the synthesis of surfactants and polymers; studying the apparatus and equipment for chemical processing of hydrocarbons; analyzing ways to improve and modernize technological productions.

The goal of the course is to provide students with knowledge, skills, competencies, and practical experience in the field of studying chemistry, mechanism, kinetic and thermodynamic regularities of the main organic synthesis reactions underlying large-scale organic synthesis production, studying the technological design of the main organic synthesis processes and the application areas of the manufactured products.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России" 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-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	**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. **PC-4.2.** Can draw up and prepare 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. **PC-4.3.** Has the methodology for preparing primary reporting, including work schedules, instructions, plans, estimates, applications for materials, equipment according to approved forms.
PC-5	Capable of applying the basic principles of rational	**PC-5.1.** Knows the legal and methodological framework of the procedure for conducting

Competence code	Competence descriptor	Competence formation indicators (within this course)
	use of natural resources and environmental protection	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. **PC-5.2.** 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. **PC-5.3.** 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 consequences and preventing environmental damage at production facilities.
PC-8	Able to organize the work of performers, find and make management decisions, rules for ensuring the safety of technological processes, as well as personnel when working in the field, in laboratories, during office processing	**PC-8.1.** Knows the safety rules and safety precautions when working in the field, in laboratories, during office processing. **PC-8.2.** Can justify and make management decisions in the field of organization and regulation of labor; conduct briefings on ensuring the safety of technological processes, as well as personnel when working in the field, in laboratories, during office processing. **PC-8.3.** Has the methodology for ensuring the safety of technological processes, as well as personnel when working in the field, in laboratories, during office processing.

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-4	Able to draw up technical documentation for the implementation of the	-	Comprehensive analysis of processing, storage and marketing

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
	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		of hydrocarbons; Diagnostics of oil and petroleum products main pipeline facilities; Improving the efficiency of the production process and operation of equipment for the extraction of hydrocarbons; Innovative technologies for the development of hydrocarbon deposits; Innovative technologies for the transportation and storage of hydrocarbons; 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; Technological practice (educational); Technological practice (industrial); Pre-graduation Practical Training State Exam; Graduate Qualification Work
PC-5	Capable of applying the basic principles of rational use of natural resources and environmental protection	-	Machinery and equipment for field development and transportation of hydrocarbons; Technologies for developing prospective hydrocarbon reserves; Methods for oil production intensification and enhanced oil recovery; Technological practice (educational);

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
			Technological practice (industrial) State Exam; Graduate Qualification Work
PC-8	Able to organize the work of performers, find and make management decisions, rules for ensuring the safety of technological processes, as well as personnel when working in the field, in laboratories, during office processing	-	Technological practice (industrial); Technological processes of pipeline transport; Technologies for developing prospective hydrocarbon reserves; Pre-graduation Practical Training State Exam; Graduate Qualification Work

* 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 "Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России" 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)**
			1
Contact academic hours, acc .		*36*	*36*
including:		18	18
Lectures			
Laboratory work			
Seminars (workshops/tutorials)		36	36
Self-study (ies), academic hours		*99*	*99*
Evaluation and assessment (exam or pass/fail grading)		*27*	*27*
The course total workload	acc.hrs.	**180**	**180**
	Credits	**5**	**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	State and Development Trends of the Global Oil and Gas Refining Industry	1.1	Prospects for the production and application of commercial petroleum and gas products.	Analysis of global demand for petroleum products. Promising areas: production of hydrogen, Group III/IV base oils, bitumens, coke. Impact of the "energy transition" (decarbonization, CO_2 capture, electric vehicles) on the product portfolio of refineries and gas	LC, S

				processing plants. Role of hydrogen, LPG, base oils.	
2	Technology of Oil and Gas Condensate Treatment Prior to Refining	2.1	Methods for treating oil and gas condensate prior to refining and separation.	Physicochemical fundamentals of breaking water-oil emulsions (demulsifiers, thermochemical treatment, electro-dehydration). Electrolytic desalting unit. Stabilization and de-ethanization. Removal of mechanical impurities and salts. Basic process flow diagrams for treatment prior to feeding to the atmospheric-vacuum distillation unit.	LC, S
		2.2	Technology of separation treatment for oil and gas condensate. Separation unit equipment.	Separation unit equipment. Three-phase separation (gas – oil – water). Types of separators: horizontal, vertical, inclined, compact (pipe). Design of inlet devices, vane and mesh mist eliminators, level gauges. Low-temperature separation (LTS) for gas condensate – condensate recovery upon cooling. Hydrate prevention (inhibitors, heating). Examples of industrial separation units (integrated gas treatment units, central collection and treatment points).	LC, S
3	Technology of Oil and Gas Condensate Refining	3.1	Atmospheric-vacuum distillation (AVT), deasphalting, and dewaxing.	Atmospheric distillation of oil and gas condensates; atmospheric-vacuum distillation of oil, technological fundamentals of separation and purification of distillates and residues using various reagents, deasphalting, dewaxing.	LC, S
		3.2	New directions in oil, gas, and gas condensate refining technology.	Digital twins, AI-based refinery management, gas condensate processing to aromatics, GTL technologies, small-scale LNG.	LC, S
4	Secondary Processing of Petroleum Feedstock	4.1	Thermal processes for petroleum feedstock processing.	Visbreaking, coking, naphtha pyrolysis. Reduction of fuel oil viscosity, production of coke, ethylene, propylene.	LC, S
		4.2	Catalytic processes for petroleum feedstock processing.	Fluid catalytic cracking (FCC), reforming, isomerization, alkylation. Zeolite and platinum catalysts.	LC, S
		4.3	Hydrocatalytic processes for petroleum feedstock processing.	Hydrotreating (HDS, HDN), hydrocracking (single-stage and two-stage). Removal of sulfur, nitrogen, metals.	LC, S
5	Gas Processing Technology	5.1	Fuel gases: classification, thermodynamics, and selection of processing schemes.	Classification of types of process fuel, physicochemical fundamentals of developing processing technologies for liquid hydrocarbon feedstock and gas. Phase equilibria, calorific value, selection of processing scheme.	LC, S
		5.2	Methods for treatment and purification of natural gases.	Dehydration (glycols, zeolites), removal of H_2S/CO_2 (amines, Sulfinol). Gas fractionation (ethane, propane, butane). GTL, helium, sulfur, LPG.	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. Kapustin, V. M. Technology of oil refining [Text]: textbook for students of higher educational institutions studying in the specialty "Chemical technology of natural energy carriers and carbon materials" of the training direction for certified specialists "Chemical technology of organic substances and fuel": [in 4 parts] / V. M. Kapustin; edited by O. F. Glagoleva. – Moscow: Gubkin Russian State University of Oil and Gas, 2019-. – 24 cm. – (Textbooks and study guides for students of higher educational institutions). – ISBN 978-5-9933-0163-1.

2. Solodova, N. L., Khalikova, D. A. Main directions of oil and gas refining in Russia: textbook / Ministry of Education and Science of Russia, Kazan National Research Technological University. – Kazan: Kazan Scientific Research Technological University (KNRTU), 2012. – 122 p.

3. Zarifyanova, M. Z., Puchkova, T. L., Sharifullin, A. V. Chemistry and technology of secondary oil refining processes: textbook / Ministry of Education and Science of Russia, Kazan National Research Technological University. – Kazan: Kazan Scientific Research Technological University (KNRTU), 2015. – 156 p.

Additional(optional) reading (sources):

4. Ponomareva, G. A. Hydrocarbons of oil and gas: physicochemical properties: textbook. – Orenburg: OSU, 2016. – 98 p.

5. Kukurina, O. S., Lyapkov, A. A. Technology of hydrocarbon feedstock refining: textbook. – Saint Petersburg: Lan, 2020. – 168 p. – ISBN 978-5-8114-4241-6.

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 Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России.
2. Guidelines for students on the development of the course Modern stream in oil and gas processing in Russia / Современные направления нефтегазопереработки в России.

*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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