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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**

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

## **COURSE SYLLABUS**

**Technological processes of pipeline transport / Технологические процессы  
трубопроводного транспорта / Технологические процессы трубопроводного  
транспорта**

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course title

**Recommended by the Didactic Council for the Education Field of:**

**21.04.01 Oil and Gas Engineering**

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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**

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higher education programme profile/specialisation title

## 1. COURSE GOAL(s)

The discipline "Technological processes of pipeline transport / Технологические процессы трубопроводного транспорта" 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 1-2 semesters of master 1. The discipline is delivered by the Department of Mineral Developing and Oil & Gas Engineering. It consists of 20 sections and 26 topics and is aimed at undergraduates studying technological processes of pipeline transportation of hydrocarbons, as well as developing skills and abilities to use regulatory and technical documentation; performing calculations, related to the implementation of design solutions; to assess risks and determine measures to ensure the safety of technological processes for pipeline transportation of hydrocarbons.

The goal of mastering the discipline is to provide undergraduates with theoretical and practical knowledge to form the necessary level of professional competencies in the field of technological processes of pipeline transport.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Technological processes of pipeline transport / Технологические процессы трубопроводного транспорта / Технологические процессы трубопроводного транспорта" 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)
GPC-3	Able to develop scientific and technical, design and service documentation, draw up scientific and technical reports, surveys, publications, reviews	GPC-3.1. Knows methods for evaluating the types of entrepreneurial activities used in the enterprise. GPC-3.2. Can use the basics of logistics, in relation to an oil and gas enterprise, when the main technological operations are performed in conditions of uncertainty; put into practice the elements of production management; use the opportunities for entrepreneurial activities at the entrusted facility and its legislative regulation; find the possibility of combining the performance of basic duties with elements of entrepreneurship. GPC-3.3. Has the skills of personnel management in a small production unit.
PC-7	Able to manage the work on the diagnostic examination of the main oil pipelines (MOP) and the main oil product pipelines (MOPP) facilities	PC-7.1 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

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p>and operational documentation for the direction of activity  Rules for working with specialized software systems  Requirements for labor protection, industrial, fire and environmental safety  PC-7.2 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  PC-7.3 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</p>
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, in 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 elective 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*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules*</b>	<b>Subsequent courses/modules*</b>
<b>GPC-3</b>	Able to develop scientific and technical, design and service documentation, draw up scientific and technical reports, surveys, publications, reviews	Information technologies in the oil and gas industry; Research Work (Obtaining Primary Skills in Research Work)	State Exam; Graduate Qualification Work
<b>PC-7</b>	Able to manage the work on the diagnostic examination of the main oil pipelines (MOP) and the main oil product pipelines (MOPP) facilities	Diagnostics of oil and petroleum products main pipeline facilities; Well Repair and Water Breakthrough Control Technologies	Pre-graduation Practical Training; State Exam; Graduate Qualification Work
<b>PC-8</b>	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, in office processing	Project management in the oil and gas industry; Economics and management of oil and gas production	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 "Technological processes of pipeline transport / Технологические процессы трубопроводного транспорта / Технологические процессы трубопроводного транспорта" is 8 credits.

*Table 4.1 Types of academic activities during the period of the HE programme mastering*

<b>Type of study work</b>	<b>TOTAL, acc.hrs.</b>	<b>Semester(s)</b>		
		<b>1</b>	<b>2</b>	
<i>Contact academic hours, acc .</i>	<i>87</i>	<i>36</i>	<i>51</i>	
<b>including:</b>	<b>35</b>	<b>18</b>	<b>17</b>	
Lectures				
Laboratory work				
Seminars (workshops/tutorials)	52	18	34	
<i>Self-study (ies), academic hours</i>	<i>174</i>	<i>117</i>	<i>57</i>	
<i>Evaluation and assessment (exam or pass/fail grading)</i>	<i>27</i>	<i>27</i>		
<b>The course total workload</b>	acc.hrs.	<b>288</b>	<b>180</b>	<b>108</b>
	Credits	<b>8</b>	<b>5</b>	<b>3</b>

#### 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	General Information about Hydrocarbons	1.1	General Information about Hydrocarbons (Oil and Petroleum Products)	Physicochemical and technological properties of oil and petroleum products. Rheological properties of oil. Determination of density and viscosity of oil and petroleum products.	LC, S
		1.2	General Information about Hydrocarbons (Natural Gas)	Methods for determining physical properties of natural gas. Physicochemical and operational properties of natural gas. Determination of main thermodynamic characteristics of natural gas.	LC, S
2	Hydrocarbon Transport Systems	2.1	Features of Hydrocarbon Transport Systems	General characteristics of hydrocarbon transport systems. Classification of main oil pipelines and gas pipelines. Pipes and pipeline fittings. Advantages and disadvantages of different transport modes.	LC, S
		2.2	Mathematical Modeling of Transport Systems	Determination of the shortest path between producer and consumer using graph theory.	LC, S
3	Main Technological Facilities for Pipeline Transport, Storage, and Marketing of Oil, Petroleum Products, and Hydrocarbon Gases	3.1	Composition of Main Pipeline Facilities	Development of process flow diagrams for main pipeline facilities. Main technological facilities for oil and natural gas transport and storage. Design schemes of main oil and gas pipelines. Production-marketing chain and logistics chain.	LC, S
4	Hydraulic Calculation of a Main Oil Pipeline	4.1	Bernoulli's Equation	Derivation of Bernoulli's equation from the law of energy conservation as applied to pipeline transport.	LC, S
		4.2	Fluid Flow Regimes in a Pipeline	Determination of fluid flow regime in a pipeline. Determination of friction head losses and local head losses. Problem of determining hydraulic resistance coefficients. Problem of determining head loss.	LC, S
		4.3	Characteristics of the Compressed Pipeline Route Profile	Compressed profile. Construction of the pipeline profile. Types of heads. Problems on Bernoulli's equation.	LC, S
5	Increasing the Capacity of a Main Oil Pipeline	5.1	Methodology for Increasing the Capacity of a Main Oil Pipeline	Main methods for increasing the capacity of a main oil pipeline. Increasing pipeline capacity by laying loops and inserts.	LC, S

6	Hot Tapping into a Pipeline	6.1	Basic Principles of Hot Tapping	Technology for performing hot tapping into a pipeline. Detection of leak location in an oil pipeline or illegal tapping point.	LC, S
7	Pumping Stations	7.1	General Characteristics of Pumping Stations	Main and auxiliary equipment of pumping stations. Process flow diagrams for pump unit piping. Main equipment of pump rooms. Determination of pump unit performance characteristics.	LC, S
		7.2	Joint Operation of Pumping Station and Oil Pipeline	Study and application of calculation relationships for joint operation of pumping station and oil pipeline.	LC, S
8	Design and Operation of Oil Depots	8.1	Main Stages of Design and Operation of Oil Depots and Tank Farms	Commercial petroleum products and basics of their application. Location and capacity determination of oil depots. Steel tanks. Reinforced concrete tanks. Process equipment for tanks. Transport and receiving/shipping means for crude oil and petroleum products. Classification of oil depots and tanks.	LC, S
9	Batch Transportation Technology	9.1	General Characteristics of Batch Transportation Technology for Oil and Petroleum Products	Fundamentals of batch transportation technology for petroleum products. Mixing process. Determination of mixture volume. Influence of pumping regimes.	LC, S
10	Losses of Oil and Petroleum Products. Methods for Reducing Losses	10.1	General Information on Losses of Oil and Petroleum Products	Losses of oil and petroleum products and methods for their reduction. Large and small breathing. Determination of loss volume from a damaged tank.	LC, S
11	Calculation of Geometric Parameters of Vertical Steel Tanks (VST)	11.1	Basic Principles for Calculating Geometric Parameters of VST	Calculation of geometric parameters of vertical steel tanks. Determination of optimal tank dimensions. Calculation of tank wall thickness.	LC, S
12	Mathematical Modeling in Hydrocarbon Transport	12.1	Mathematical Modeling in Hydrocarbon Transport Using Approximation and Interpolation Methods	Approximation and interpolation. Least squares method. Development of mathematical models using approximation and interpolation principles.	LC, S
		12.2	Mathematical Modeling in Hydrocarbon Transport Using Linear Programming Methods	Linear programming problems. Simplex method. Transportation problem. Assignment problem. Development of mathematical models using linear programming principles.	LC, S
13	Gas Compressor Stations	13.1	Main Characteristics of Gas	Process flow diagrams for compressor unit piping. Main equipment of compressor rooms. Determination of compressor unit	LC, S

			Compressor Stations	performance characteristics. Calculation of power and fuel gas consumption for gas compressor units with gas turbine and gas engine drives.	
14	Calculation of Simple Gas Pipelines	14.1	Methodology for Calculating Simple Gas Pipelines	Continuity and flow motion equations for gas. Gas pressure variation along the pipeline length. Optimal gas pipeline parameters. Calculation of natural gas pumping regime along the mainline. Placement of compressor stations along the route.	LC, S
15	Gas Distribution Networks	15.1	Main Characteristics of Gas Distribution Networks and Gas Distribution Stations	General concepts of gas distribution networks. Classification of gas supply system pipelines. Structure and schemes of gas networks. Gas Distribution Stations (GDS). Classification of GDS and Gas Distribution Points (GDP). Schemes and equipment of GDS. Determination of gas consumption volumes.	LC, S
16	Unevenness of Gas Consumption	16.1	Characteristics of Gas Consumption Unevenness in Russia and Abroad	Use of natural gas. Types of natural gas consumption unevenness. Brief characteristics of methods for covering gas consumption unevenness.	LC, S
17	Classification of Gas Storage Facilities	17.1	Classification Criteria for Underground Gas Storage (UGS)	Classification of storage facilities depending on the stored product's aggregate state, their brief characteristics. Classification depending on spatial location, their brief characteristics.	LC, S
18	Classification of UGS. General Layout, Systems, and Equipment of UGS	18.1	General Characteristics of UGS Facilities and Systems	Identification of criteria for classifying UGS. Study of the UGS classification system. General layout of UGS. Characteristics of main systems and facilities included in UGS. Description of operating principles of main facilities and their interaction.	LC, S
19	Small-Scale LNG Production	19.1	General Characteristics of Small-Scale LNG Production	Prospects for small-scale LNG production development. Natural gas liquefaction process, basic process flow diagram. Physicochemical properties of LNG. Basic diagram of a small-scale LNG production unit. Tanks for LNG storage. LNG transport facilities. Basic diagram of a regasification unit. Process flow diagram for LNG supply to a facility.	LC, S
20	Theory of Choice and Decision-Making for Optimal Hydrocarbon Transport Technology	20.1	Fundamentals of Choice and Decision-Making Theory	Search for optimal hydrocarbon transport technology. Rating method. Method of guaranteed advantages and disadvantages.	LC, S

\*Key: LK – Lectures; PC – Practical/Seminar Classes (only for full-time study)

## 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. Tetelmin, V. V. Oil and Gas Engineering. Complete course. Volume 1: textbook / V. V. Tetelmin. – 3rd ed. – Moscow; Vologda: Infra-Engineering, 2024. – 416 p. – ISBN 978-5-9729-2021-1. – Text: electronic. – URL: <https://znanium.ru/catalog/product/2170585>
2. Tetelmin, V. V. Oil and Gas Engineering. Complete course. Volume 2: textbook / V. V. Tetelmin. – 3rd ed. – Moscow; Vologda: Infra-Engineering, 2024. – 400 p. – ISBN 978-5-9729-2022-8. – Text: electronic. – URL: <https://znanium.ru/catalog/product/2170586>
3. Poluboyartsev, E. L., Isupova, E. V. Pipeline transport of oil and gas: textbook / E. L. Poluboyartsev, E. V. Isupova. – Moscow; Vologda: Infra-Engineering, 2022. – 212 p. – ISBN 978-5-9729-1000-7. – Text: electronic. – URL: <https://znanium.com/catalog/product/1904198>
4. Jatto, A. L. A. Oil and Gas Pipeline Infrastructure Insecurity. – Springer, 2024. – DOI: <https://doi.org/10.1007/978-3-031-56932-6>

### *Additional(optional) reading (sources):*

5. Ilkevich, N. I. Construction and operation of gas and oil pipelines and gas and oil storage facilities: textbook / N. I. Ilkevich. – 2nd ed. – Moscow; Vologda: Infra-Engineering, 2025. – 124 p. – ISBN 978-5-9729-2415-8. – Text: electronic. – URL: <https://znanium.ru/catalog/product/2225727>
6. Bukleshev, D. O., Buzuev, I. I., Sumarchenkova, I. A., Yagovkin, N. G. Ensuring safe operation of pipeline transport facilities: educational and methodological manual. – Moscow; Vologda: Infra-Engineering, 2023. – 128 p. – ISBN 978-5-9729-1438-8. – Text:

electronic. – URL: <https://znanium.ru/catalog/product/2096121>

7. Shalay, V. V., Makushev, Yu. P. Design and operation of oil depots and filling stations: textbook / V. V. Shalay, Yu. P. Makushev. – Moscow; Vologda: Infra-Engineering, 2022. – 316 p. – ISBN 978-5-9729-0984-1. – Text: electronic. – URL: <https://znanium.com/catalog/product/1904192>

8. Li, Z. Pipeline Spatial Data Modeling and Pipeline WebGIS: Digital Oil and Gas Pipeline: Research and Practice. – Springer, 2020. – DOI: <https://doi.org/10.5555/3385353>

9. Kovalenko, Y., Karev, V. Geomechanical Aspects of Operation of Underground Gas Storage. – Springer, 2023. – DOI: <https://doi.org/10.1007/978-3-031-34765-8>

#### *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/>

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 Technological processes of pipeline transport / Технологические процессы трубопроводного транспорта / Технологические процессы трубопроводного транспорта.

2. Guidelines for students on the development of the course "Technological processes of pipeline transport / Технологические процессы трубопроводного транспорта / Технологические процессы трубопроводного транспорта".

\*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.

**DEVELOPERS:**

Senior Lecturer of the Department of Mineral Developing  
and Oil&Gas Engineering

Pivnov V.P.

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position, department

name and surname

**HEAD OF EDUCATIONAL DEPARTMENT:**

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Kotelnikov A.E.

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name of department

name and surname

**HEAD****OF HIGHER EDUCATION PROGRAMME:**

Professor of the Department of Mineral Developing and  
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Kapustin V.M.

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