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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 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**

**Fundamentals of construction and operation of pipeline transport / Основы  
строительства и эксплуатации трубопроводного транспорта / Основы  
строительства и эксплуатации 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 "Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации 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 1st and 2nd semesters of the 1st year. The discipline is delivered by the Department of Mineral Developing and Oil & Gas Engineering. It consists of 3 sections and 13 topics and is aimed at a comprehensive study of the classification, main operational parameters, and regulatory requirements for main oil and gas pipelines. Within the course, students master the stages and technology of performing the full range of construction works, including preparatory, earthworks, welding, insulation-laying, and other processes. Special attention is paid to methods and means of quality control of welded joints and insulation coatings. Students become familiar with the principles of construction organization, such as the development of a Construction Organization Plan, a Work Execution Plan, and a construction site master plan, as well as issues of transport logistics. The course enables students to learn to distinguish and analyze methods for constructing pipeline crossings over natural and artificial obstacles, including rivers, roads, and ravines. Methods of hydraulic and pneumatic testing of pipelines for strength and tightness are studied. Furthermore, the discipline is aimed at acquiring skills in solving practical problems, such as calculating earthwork volumes and selecting transport vehicles, using regulatory documentation, including SNiP (Construction Norms and Regulations) and VSN (Departmental Building Norms).

The goal of the discipline is to obtain knowledge, skills, and experience in the field of construction of pipeline transport facilities, and to form in students a set of theoretical knowledge and practical understanding of the technological processes, organization, and technical means used in the construction, testing, and commissioning of main pipelines.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The course "Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации 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)
PC-3	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	PC-3.1 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 materials; control systems used to check objects (products) of a certain type; metrological support;

Competence code	Competence descriptor	Competence formation indicators (within this course)
		<p>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>PC-3.2 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>PC-3.3 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>
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	<p>PC-7.1 Knows:</p> <p>Methods for organizing work on in-line diagnostic inspection of the MOP and MOPP using in-line inspection devices</p> <p>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</p> <p>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</p> <p>The procedure for the formation of long-term development plans in the field of diagnostic work at the facilities of MOP and MOPP</p> <p>The procedure for the development of design, executive and operational documentation for the direction of activity</p> <p>Rules for working with specialized software systems</p> <p>Requirements for labor protection, industrial, fire and environmental safety</p> <p>PC-7.2 Can:</p> <p>Determine the scope and procedure for performing work on the diagnostic examination of the MOP and MOPP</p> <p>Assess the compliance of work performance with the requirements of the technological process for diagnosing objects of MOP and MOPP</p> <p>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,</p>

Competence code	Competence descriptor	Competence formation indicators (within this course)
		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

### 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*

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
PC-3	Able to manage the system for monitoring the technical condition and technical diagnostics at the facilities and plants of the oil and gas complex	Diagnostics of oil and petroleum products main pipeline facilities; Innovative technologies for the transportation and storage of hydrocarbons; Methods for Oil Production Intensification and Enhanced Oil Recovery	Pre-graduation Practical Training; Final State Examination
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	Diagnostics of oil and petroleum products main pipeline facilities; Well Repair and Water Breakthrough Control Technologies	Pre-graduation Practical Training; Final State Examination

\* 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 "Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации трубопроводного транспорта" is 7 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	2
<i>Contact academic hours, acc .</i>	105	54	51
including:	35	18	17
Lectures			
Laboratory work			
Seminars (workshops/tutorials)	70	36	34
<i>Self-study (ies), academic hours</i>	120	54	66
<i>Evaluation and assessment (exam or pass/fail grading)</i>	27		27
<b>The course total workload</b>	acc.hrs.	<b>252</b>	<b>108</b>
	Credits	<b>7</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	Fundamentals of Design, Classification, and Construction Preparation	1.1	Classification and General Information about Pipelines	Classes of oil and gas pipelines, categories, laying schemes (underground, aboveground), main operational indicators.	LC, S
		1.2	Construction Organization	Study of design documentation: Construction Organization Plan (COP), Work Execution Plan (WEP), standard technological flowcharts (STF), concept of construction site master plan (facility-specific and overall site).	LC, S
		1.3	Preparatory Stage of Construction	Three stages of the preparatory period: organizational (documentation), mobilization (bases, warehouses, personnel), and preparatory-technological (right-of-way clearing, geodesy, roads).	LC, S
		1.4	Geodetic and Earthworks during the Preparatory Period	Creation of a geodetic staking base, restoration of the route axis. Clearing the strip of forest, removing topsoil, dewatering, territory grading.	LC, S
		1.5	Transport and Warehouse Support	Types of transport routes (pendulum, circular). Delivery of pipes, sections, fittings. Organization of rail-side, base, and right-of-way warehouses.	LC, S
2	Technology and Organization of the Main	2.1	Earthworks	Soil excavation by cutting (excavators, bulldozers, scrapers) and by blasting. Trench digging, backfilling. Calculation of trench volume and equipment selection.	LC, S

	Construction Stage	2.2	Welding and Assembly Works	Pipe assembly at the trench edge, edge cleaning. Types of arc welding. Use of internal and external line-up clamps. Inspection of welded joints (visual, non-destructive).	LC, S
		2.3	Insulation and Laying Works	Joint insulation using heat-shrinkable sleeves. Cleaning and coating machines. Combined and separate laying methods. Installation of “overlaps” and coils. Safety procedures.	LC, S
		2.4	Installation of Valve Units and Cavity Cleaning	Internal cavity cleaning by purging or washing (with or without a pig). Installation of a valve unit: pit excavation, pipe cutting, welding.	LC, S
		2.5	Pipeline Testing	Purpose of testing – checking strength and tightness. Hydraulic method (water), pneumatic method (air/gas), combined method. Procedure, evaluation criteria.	LC, S
3	Special Structures and Practical Calculations	3.1	Features of Constructing Main Pipeline Crossings over Natural and Artificial Obstacles	Types of obstacles (rivers, swamps, roads). Aerial crossings (beam, arch, self-supporting). Underground crossings under roads (trenchless methods – puncture, jacking, HDD).	LC, S
		3.2	Construction of Underwater Crossings (Ducts)	Crossing boundaries. Construction site preparation. Excavation of underwater trenches (dredgers, hydraulic monitors). Pipe ballasting, coating. Laying methods (pulling, free immersion).	LC, S
		3.3	Practical Work and Calculations	Problem solving: determining a rational transport scheme, calculating the required number of vehicles, calculating rigging equipment, determining pile parameters, calculating earthwork volume (trench) considering soil type and slopes, selecting an excavator by capacity, calculating welding parameters.	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	

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
	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. Prachev, Yu. N., Verzhbitsky, V. V. Construction and repair of the linear part of main pipelines: textbook / Ministry of Education and Science of the Russian Federation, Federal State Autonomous Educational Institution of Higher Professional Education "North Caucasus Federal University". – Stavropol: NCFU, 2014. – 238 p.

2. Verzhbitsky, V. V., Prachev, Yu. N. Fundamentals of construction of oil and gas transport facilities: textbook / Ministry of Education and Science of the Russian Federation, Federal State Autonomous Educational Institution of Higher Professional Education "North Caucasus Federal University". – Stavropol: NCFU, 2014. – 154 p.

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

3. Gladenko, A. A., Chekardovsky, S. M., Podorozhnikov, S. Yu., et al. Pipeline transport and storage of hydrocarbon resources: examples of solving typical problems: textbook: in 2 volumes / edited by Yu. D. Zemenkov; Ministry of Education and Science of Russia, Omsk State Technical University, Tyumen Industrial University. – Omsk: OmSTU Publishing House, 2017. – Vol. 1. – 427 p. : tables, graphs, ill. – Bibliography: pp. 367-391. – ISBN 978-5-8149-2550-3. – ISBN 978-5-8149-2551-0 (vol. 1)

4. Gladenko, A. A., Chekardovsky, S. M., Podorozhnikov, S. Yu., et al. Pipeline transport and storage of hydrocarbon resources: examples of solving typical problems: textbook: in 2 volumes / edited by Yu. D. Zemenkov; Ministry of Education and Science of Russia, Omsk State Technical University, Tyumen Industrial University. – Omsk: OmSTU Publishing House, 2017. – Vol. 2. – 352 p. : tables, graphs, ill. – Bibliography: pp. 367-391. – ISBN 978-5-8149-2550-3. – ISBN 978-5-8149-2552-7 (vol. 2)

### *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 Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации трубопроводного транспорта.

2. Guidelines for students on the development of the course "Fundamentals of construction and operation of pipeline transport / Основы строительства и эксплуатации 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:**

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

Berdnik M.M.

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position, department

name and surname

**HEAD OF EDUCATIONAL DEPARTMENT:**

Mineral Developing and Oil&Gas Engineering

Kotelnikov A.E.

---

name of department

name and surname

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

Professor of the Department of Mineral Developing and  
Oil&Gas Engineering

Kapustin V.M.

---

position, department

name and surname