

**Ministry of Education and Science of Ukraine
Dnipro University of Technology**

**MINING FACULTY
DEPARTMENT OF TRANSPORT SYSTEMS AND TECHNOLOGIES**

“APPROVED”

Head of Department

Shirin L.N. 

“ ___ ” _____ 2018

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

" Processes of underground storage of hydrocarbons "

Field of study.....	18 Production and Technology
Specialty.....	185 Oil and Gas Engineering and Technology
Academic degree.....	Bachelor
Academic program.....	Oil and Gas Engineering and Technology
Language of study.....	English

Prolonged: for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

Dnipro
NTU “DP”
2018

Work program of the academic discipline “Processes of underground storage of hydrocarbons” for bachelor’s specialty 185 “Oil and Gas Engineering and Technology” / L.N.Shyrin, Fedorenko EA / NTU “Dnipro Polytechnic” Department of transport systems and technologies. - DA: NTU «DP» 2018 - 13 p.

Autors:

Shirin LN, professor of transport systems and technologies

Fedorenko EA, assistant professor of transport systems and technologies

The work program regulates:

- key goals and objectives;
- the disciplinary learning outcomes generated through the transformation of the intended learning outcomes of the degree program;
- the content of the discipline formed according to the criterion “disciplinary learning outcomes”;
- the discipline program (thematic plan by different types of classes);
- distribution of the discipline workload by different types of classes;
- an algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and evaluation criteria);
- criteria and procedures for evaluating the academic achievements of applicants by discipline;
- the contents of the educational and methodological support of the discipline;

The work program is designed to implement a competency approach in planning an education process, delivery of the academic discipline, preparing students for control activities, controlling the implementation of educational activities, internal and external quality assurance in higher education, accreditation of degree programs within the specialty.

CONTENTS

1 DISCIPLINE OBJECTIVES	4
2 INTENDED DISCIPLINARY LEARNING OUTCOMES	4
3 BASIC DISCIPLINES	4
4 WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES	5
5 DISCIPLINE PROGRAM BY TYPES OF CLASSES	5
6 KNOWLEDGE PROGRESS TESTING	6
6.1 GRADING SCALES	6
6.2 DIAGNOSTIC TOOLS AND EVALUATION PROCEDURES.....	7
6.3 EVALUATION CRITERIA	8
7 TOOLS, EQUIPMENT, AND SOFTWARE	11

1 DISCIPLINE OBJECTIVES

In the educational and professional programs of the Dnipro University of Technology specialty 185 “Oil and gas engineering and technology”, the distribution of program learning outcomes (NRN) for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the discipline V2.15 "The processes of underground storage of hydrocarbons ":

VR2.1	Create elements of the technology of extraction, transportation and storage of carbohydrate energy
VR2.3	Calculate and adjust the modes of gas-oil supply for various conditions
VR2.4	Use practical methods of diagnosis efficiency of gas-oil supply
VR2.5	To ensure the safety of the components of the gas oil supply in accordance with the operating rules
VR2.6	Assess the quality and restore the properties of the elements of the gas oil supply for specific conditions
VR2.7	Provide regulatory and technical support for the creation, operation and recovery systems and energy storage technologies carbohydrate

The objective of discipline - formation of learning outcomes to ensure the reliability of the systems storage of oil and gas.

The implementation of the objective requires transforming program learning outcomes into the disciplinary ones as well as an adequate selection of the contents of the discipline according to this criterion.

2 INTENDED DISCIPLINARY LEARNING OUTCOMES

Code NRN	Disciplinary learning outcomes (DRN)	
	DRN code	content
VR2.1	VR2.1-V2.15	analyze technological and computational circuit elements of technical drilling wells for the injection and the selection of underground storage of hydrocarbons.
VR2.3	VR2.3- V2.15	characterize the basic elements of storage of oil and gas
VR2.4	VR2.4- V2.15	know the basics of creating elements of technological schemes and technical devices for pumping and selection hydrocarbons from underground
VR2.5	VR2.5- V2.15	be aware of the construction features of the collection and preparation of hydrocarbons for transport
VR2.6	VR2.6- V2.15	to know about controls and processes to ensure the diagnosis of underground storage of hydrocarbons
VR2.7	VR2.7- V2.15	know the basics of normative and technical support processes of environmental protection within the underground hazonaftoshovysch

3 BASIC DISCIPLINES

Subjects	The acquired learning outcomes
F2 Fundamentals of Oil and Gas business	understanding of the problems of oil and gas exploration, development patterns oil and GasIts place in society development, engineering and technology
F14 Drilling (oil and gas)	determining the process parameters of injection and production wells in the development of Oil and Gas
F13 Fundamentals of transport and	know the functionality of the preparation of oil and gas

Subjects	The acquired learning outcomes
storage of hydrocarbons	transportation, storage technologies hydrocarbons and especially their distribution among consumers

4 WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES

Type of classes	Workload hours	Distribution by forms of education, <i>hours</i>					
		Full-time		Part-time		Distance	
		Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)
Lectures	80	26	54	14	66	6	74
Practical	40	13	27	6	34	4	36
Laboratory	-	-	-	-	-	-	-
Workshops	-	-	-	-	-	-	-
Total	120	39	81	20	100	10	110

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

Ciphers DRN	Types and topics of training sessions	The volume of components, <i>hours</i>
	LECTURES	80
VR2.1-V2.15 VR2.3- V2.15	1 General information about gas supply system Preface. 1.1 Structure of the existing mains 1.2. Features gas consumption modes 1.3 Methods compensation seasonal, daily and hourly fluctuations in gas consumption 1.4 Industrial appointments and tasks gas storage	9
VR2.3- V2.15	2 Types of gas storage facilities and conditions for their functioning 2.1 Purpose and conditions of the location of underground gas storage 2.2 Performance indicators UGS 2.3 The effectiveness of the PSC and the requirements for them 2.4 Performance indicators UGS	9
VR2.1-V2.15 VR2.3- V2.15	3Modes gas deposits in the operation of UGS 3.1 Gas mode UGS 3.2 Water mode UGS 3.3 Technological stages of obtaining gas 3.4 Schematic flowsheet and conditions of the arrangement UGS 3.5 buffer gas underground storage 3.6 Estimated parameters of underground gas storage	9
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	4Flow charts and processes underground storage facilities 4.1 Overview of process gas storage 4.2 The process gas injection 4.3 The selection process gas from storage facilities 4.4 The processes of cleaning and drying gas 4.5 Operating underground gas storage	9

Ciphers DRN	Types and topics of training sessions	The volume of components, hours
	4.6 Tank-drilling operation analogy UGS	
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	5 Features of underground gas storage in depleted gas fields	9
	5.1 Features of operation of UGS in depleted gas fields	
	5.2. Calculation of the gas injection into the reservoir in the Gaseous mode	
	5.3. Calculation of parameters of gas in the operation of UGS	
	5.4. Study modes of injection-production wells during underground gas storage	
	5.5. Underground gas storage of waste oil and condensate field	
	5.6 Technical and economic analysis of performance indicators PSG	
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	6 Technology building underground mine lining sheets type	9
	6.1 Flow charts mine lining sheets hazonaftoshovysch	
	6.2 Methods gas storage facilities workings mine lining sheets	
	6.3 Defining workings, underground storage tanks mine lining sheets type	
	6.4 Method of computing optimal parameters workings-capacity and assess their strength	
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	7 construction technology of underground tanks in salt deposits.	9
	7.1 Physico-chemical basis of the process of dissolution of salt	
	7.2 Methods for construction of underground storage in salt deposits	
	7.3 Technology in the construction of underground tanks salts	
	7.4 Operation of gas storage in salt domes	
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	8 Alternative construction of underground gas storage facilities	9
	8.1 Technology kamufletnyy construction of underground explosions	
	8.2 Technology building insulated underground storage facilities	
VR2.7- V2.15	9 Precautions when operating underground gas storage	8
	PRACTICAL TRAINING	40
VR2.4- V2.15 VR2.5- V2.15 VR2.6- V2.15	1 Decision of situational learning problems similar to those found in the specialist can its activities	40
	TOTAL	120

6 KNOWLEDGE PROGRESS TESTING

Certification of student achievement is accomplished through transparent procedures based on objective criteria in accordance with the University Regulations “On Evaluation of Higher Education Applicants' Learning Outcomes”.

The level of competencies achieved in relation to the expectations, identified during the control activities, reflects the real result of the student's study of the discipline.

6.1 GRADING SCALES

Assessment of academic achievement of students of the Dnipro University of Technology is carried out based on a rating (100-point) and institutional grading

scales. The latter is necessary (in the official absence of a national scale) to convert (transfer) grades for mobile students.

The scales of assessment of learning outcomes of the NTUDP students

Rating	Institutional
90 ... 100	Excellent
74 ... 89	Good
60 ... 73	Satisfactory
0 ... 59	Failed

Discipline credits are scored if the student has a final grade of at least 60 points. A lower grade is considered to be an academic debt that is subject to liquidation in accordance with the Regulations on the Organization of the Educational Process of NTUDP.

6.2 DIAGNOSTIC TOOLS AND EVALUATION PROCEDURES

The content of diagnostic tools is aimed at controlling the level of knowledge, skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 7th qualification level during the demonstration of the learning outcomes regulated by the work program.

During the control activities, the student should perform tasks focused solely on the demonstration of disciplinary learning outcomes (Section 2).

Diagnostic tools provided to students at the control activities in the form of tasks for the intermediate and final knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the intermediate and final knowledge progress testing are approved by the appropriate department.

Type of diagnostic tools and procedures for evaluating the intermediate and final knowledge progress testing are given below.

Diagnostic and assessment procedures

INTERMEDIATE CONTROL			FINAL ASSESSMENT	
training sessions	diagnostic tools	procedures	diagnostic tools	procedures
lectures	control tasks for each topic	task during lectures	comprehensive reference work (CCW)	determining the average results of intermediate controls; CCW performance during the examination at the request of the student
practical	control tasks for each topic	tasks during practical classes		
	or individual task	tasks during independent work		

During the intermediate control, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Practical classes are assessed by the quality of the control or individual task.

If the content of a particular type of teaching activity is subordinated to several descriptors, then the integral value of the assessment may be determined by the weighting coefficients set by the lecturer.

Provided that the level of results of the intermediate controls of all types of training at least 60 points, the final control can be carried out without the student's immediate participation by determining the weighted average value of the obtained grades.

Regardless of the results of the intermediate control, every student during the final knowledge progress testing has the right to perform the CDF, which contains tasks covering key disciplinary learning outcomes.

The number of specific tasks of the CDF should be consistent with the allotted time for completion. The number of CDF options should ensure that the task is individualized.

The value of the mark for the implementation of the CDF is determined by the average evaluation of the components (specific tasks) and is final.

The integral value of the CDF performance assessment can be determined by taking into account the weighting factors established by the department for each NLC descriptor.

6.3 EVALUATION CRITERIA

The actual student learning outcomes are identified and measured against what is expected during the control activities using criteria that describe the student's actions to demonstrate the achievement of the learning outcomes.

To evaluate the performance of the control tasks during the intermediate control of lectures and practicals the assimilation factor is used as a criterion, which automatically adapts the indicator to the rating scale:

$$O_i = 100 a / m,$$

where a - number of correct answers or significant operations performed according to the solution standard; m - the total number of questions or substantial operations of the standard.

Individual tasks and complex control works are expertly evaluated using criteria that characterize the ratio of competency requirements and evaluation indicators to a rating scale.

The content of the criteria is based on the competencies identified by the NLC for the Bachelor's level of higher education (given below).

General criteria for achieving learning outcomes 7th qualification for LDCs (BA)

Integral competence is the ability to solve complex problems and specialized practical problems in a particular area of professional activities or in a learning process that involves the use of certain theories and methods of the relevant scientific areas and characterized by complexity and

conditions uncertainty.

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
Knowledge		
<ul style="list-style-type: none"> ◆ Conceptual knowledge acquired during the training and professional activities, including some knowledge of modern achievements; ◆ critical understanding of the main theories, principles, methods, and concepts in education and careers 	- A great - proper, reasonable, sensible. Measures the presence of: - conceptual knowledge; - a high degree of state ownership issues; - critical understanding of the main theories, principles, methods and concepts in education and careers	95-100
	A non-gross contains mistakes or errors	90-94
	The answer is correct but has some inaccuracies	85-89
	A correct some inaccuracies but has also proved insufficient	80-84
	The answer is correct but has some inaccuracies, not reasonable and meaningful	74-79
	A fragmentary	70-73
	A student shows a fuzzy idea of the object of study	65-69
	Knowledge minimally satisfactory	60-64
Knowledge unsatisfactory	<60	
Ability		
<ul style="list-style-type: none"> ◆ solving complex problems and unforeseen problems in specialized areas of professional and/or training, which involves the collection and interpretation of information (data), choice of methods and tools, the use of innovative approaches 	- The answer describes the ability to: <ul style="list-style-type: none"> - identify the problem; - formulate hypotheses; - solve problems; - choose adequate methods and tools; - collect and interpret logical and understandable information; - use innovative approaches to solving the problem 	95-100
	The answer describes the ability to apply knowledge in practice with no blunders	90-94
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of a requirement	85-89
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the two requirements	80-84
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the three requirements	74-79
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the four requirements	70-73
	The answer describes the ability to apply knowledge in practice while performing tasks on the model	65-69
	A characterizes the ability to apply knowledge in performing tasks on the model, but with uncertainties	60-64
	The level of skills is poor	<60
Communication		
<ul style="list-style-type: none"> ◆ report to specialists and non-specialists of information, ideas, problems, solutions and 	- Fluent problematic area. Clarity response (report). Language - correct; <ul style="list-style-type: none"> - - net; - - clear; 	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
<p>their experience in the field of professional activity;</p> <ul style="list-style-type: none"> ◆ the ability to form an effective communication strategy 	<ul style="list-style-type: none"> - - accurate; - - logic; - - expressive; - - concise. <p>Communication strategy: coherent and consistent development of thought; availability of own logical reasoning; relevant arguments and its compliance with the provisions defended; the correct structure of the response (report); correct answers to questions; appropriate equipment to answer questions; the ability to draw conclusions and formulate proposals</p>	
	<p>Adequate ownership industry issues with minor faults. Sufficient clarity response (report) with minor faults. Appropriate communication strategy with minor faults</p>	90-94
	<p>Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total three requirements are not implemented)</p>	85-89
	<p>Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (a total of four requirements is not implemented)</p>	80-84
	<p>Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total not implemented the five requirements)</p>	74-79
	<p>Satisfactory ownership issues of the industry. Satisfactory clarity response (report) and relevant communication strategy (a total of seven requirements not implemented)</p>	70-73
	<p>Partial ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented nine requirements)</p>	65-69
	<p>The fragmented ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented 10 requirements)</p>	60-64
	<p>The level of poor communication</p>	<60
Autonomy and responsibility		
<ul style="list-style-type: none"> ◆ management actions or complex projects, responsible for decision-making in unpredictable conditions; ◆ responsible for the professional development of individuals and/or groups ◆ the ability to continue study with a high degree of autonomy 	<ul style="list-style-type: none"> - Excellent individual ownership management competencies focused on: 1) management of complex projects, providing: <ul style="list-style-type: none"> - exploratory learning activities marked the ability to independently evaluate various life situations, events, facts, detect and defend a personal position; - the ability to work in a team; - control of their own actions; 2) responsibility for decision-making in unpredictable conditions, including: <ul style="list-style-type: none"> - justify their decisions the provisions of the regulatory framework of sectoral and national levels; - independence while performing tasks; - lead in discussing problems; 	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
	<ul style="list-style-type: none"> - responsibility for the relationship; 3) responsible for the professional development of individuals and/or groups that includes: <ul style="list-style-type: none"> - use of vocational-oriented skills; - the use of evidence from independent and correct reasoning; - possession of all kinds of learning activities; 4) the ability to further study with a high degree of autonomy, which provides: <ul style="list-style-type: none"> - degree possession of fundamental knowledge; - independent evaluation judgments; - high level of formation of general educational skills; - search and analysis of information resources 	
	Confident personality possession competency management (not implemented two requirements)	90-94
	Good knowledge management competencies personality (not implemented three requirements)	85-89
	Good knowledge management competencies personality (not implemented the four requirements)	80-84
	Good knowledge management competencies personality (not implemented six requirements)	74-79
	Satisfactory ownership of individual competence management (not implemented seven requirements)	70-73
	Satisfactory ownership of individual competence management (not implemented eight claims)	65-69
	The level of autonomy and responsibility fragmented	60-64
	The level of autonomy and responsibility poor	<60

7 TOOLS, EQUIPMENT, AND SOFTWARE

Technical training tools via multimedia software.
Distance learning platform Moodle.

8 RECOMMENDED SOURCES

1. Reference case oil / under total. Ed. BC Boyko, PM Kondrati, RS Yaremiychuka. - K. : Lvov, 1996.
2. Handbook of Petroleum operatives complex / V.V.Rozhonyuk, LA KHACHIKYAN, MA Hryhil, AS Udalov, VP Nikishin. - Kyiv "Sprout", 1998. -431 p.
3. Reference gas transportation company employee / under the general editorship of academician Ukrainian Oil and Gas Academy A.A.Rudnika - Moscow, Kyiv, "Sprout", 2001. -431 p.
4. Dudley, MA The processes of underground gas storage: a textbook. / MA Doodle, L.N.Shyrin, V.O.Salov; N-of Education and Science of Ukraine, Nat. Hearne. Univ., 2nd ed., Ext. . - D. : NSU, 2014. - 422 p.

5. RA Kantyukov Компрессорные and hazoraspredelytelnye station: учебное пособие / RA Kantyukov, VA Maksimov, MB Nadyev. - Kazan: Kazan gosunyversytet them. YOU. Ulyanov-Lenin, 2005. - 412 p.

6. Construction of tank farms and hazonaftoshovysch. Textbook for Universities / YM Bull, V. GLOBE, VP Nagorny, Y. Venhertsev. - K .: "VIPOL", 2000.- 606 p.

7. Hazonapolnytelnye and hazoraspredelytelnye station: Uchebnoe posobyе. / Pod Society. Ed. YD Zemenkova - Tyumen: Publishing "Vektor Buk", 2003.-336 with.

8. Design and operation nasosnyh and kompressornyh stations: Textbook for Universities / AM Shammazov, VN Alexandrov, AI Holyanov et al. - M .: OOO "Nedra- Byznestsentr", 2003. - 404 p.

Educational edition

WORK PROGRAM OF THE ACADEMIC DISCIPLINE
“Processes of underground storage of hydrocarbons”
185 “Oil and gas engineering and technology”

Prepared for publication
Dnipro University of Technology.
Certificate of registration in the State Register, control number 1842
49005, Dnipro, Dmytro Yavornytskoho Ave. 19