Ministry of Education and Science of Ukraine
Dnipro University of Technology

MECHANICAL ENGINEERING

DEPARTMENT OF MINING MECHANICS

"APPROVED"
Head of Department

Samus V.I. _____

"____" _____ 2018

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

" Thermodynamics and Heat Transfer "

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 “Thermodynamics and Heat Transfer” for bachelor’s specialty 185 “Oil and Gas Engineering and Technology” / M.V. Holomenyuk / NTU “Dnipro Polytechnic” Department of Foreign Language. - DA: NTU «DP» 2018 - 13 p.

Autors:

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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

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 F7 "Thermodynamics and Heat Transfer":

SR4	Perform calculations parameters hidrohazodynamichnyh processes which accompany movement oil and gas in the reservoir / wells / pipelines and industry with regard to the basic laws of thermodynamics, hydraulics and gas dynamics

The objective of discipline - Formation of competences to implement calculating the parameters hidrohazodynamichnyh processes that accompany the movement of oil and gas in the reservoir / wells / pipelines and industry with regard to the basic laws of thermodynamics.

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**
SR4	SR4-F7-1	To analyze the state of gas and gas mixtures and enerhoobminni processes in technical systems
	SR4-F7-2	To analyze gas flow thermodynamic processes and cycles
	SR4-F7-3	Analyze phase transitions in pure substances and steam flow thermodynamic processes
	F7-4-SR4	To calculate the parameters of gas flows in technical systems
	SR4-F7-5	Calculate heat flow in the processes of heat conduction, heat transfer, radiation heat transfer
	SR4-F7-6	Analyze process heat in technical systems

3 BASIC DISCIPLINES

Subjects	**The acquired learning outcomes**
B1 Mathematics 1	To apply mathematical methods to determine the specific values of process parameters gas wells, preparation of oil and gas industry and main gas, hazonaftoshovysch other system elements hazonaftopostachannya
B3 Physics 1	Use basic concepts, the basic laws of physics and chemistry for forecasting and analysis of physical and chemical properties of oil, condensate and natural gas in their production, drilling, transportation and storage

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

Type of classes	**Total hours**	**Distribution by forms of education**, *hours*		
		Full-time	**Part-time**	**Distance**

		Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)
lecture	100	34	66			12	88
practical	50	17	33			4	46
laboratory	-	-	-			-	-
workshops	-	-	-			-	-
TOGETHER	150	51	99			16	134

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

Ciphers DRN	**Types and topics of training sessions**	**The volume of components,** *hours*
	LECTURES	**34**
SR4-F7-1	**1 Basic concepts of thermodynamics**	8
	Thermodynamic system; parameters of their types and main property; equation of state of the system; thermodynamic process and its graphical interpretation	
	2 gas mixture and basic properties	
	Methods for determining the composition of the gas mixture, the partial pressure and the amount thereof; equation of state of the mixture; calculation of gas constant and apparent molecular mass of mix	
	3 The first law of thermodynamics	
	Ways to transfer energy in thermodynamic systems; internal Hainaut energy and analytical account of the first law; analytical entry as a function of the process and its graphical representation; methods determining the heat process; heat of gases; parameters of enthalpy and entropy; graphic image and process heat its dependence on the type of process	
SR4-F7 -2	**4 basic thermodynamic processes of ideal gas**	4
	General research processes of an ideal gas; basic patterns and graphical representation isochoric, isobaric, isothermal, adiabatic and polytropic process	
	5 Thermodynamic cycles	
	The thermodynamic cycle as a collection of turns made by processes of expansion and compression of the working fluid; direct thermodynamic cycle - subject to the appointment, evaluation of effectiveness; reverse thermodynamic cycle - meaning its performance evaluation cycle chillers and heat pumps; the essence of the second law of thermodynamics	
SR4-F7-3	**6 Fundamentals of Thermodynamics couple**	4
	Phase transitions in pure substances and their basic patterns; regularities of evaporation; determine the parameters Water and steam for thermal parameters and tables with charts; the procedure for calculating thermodynamic steam process	
SR4-F7-4	**7 The main provisions of the thermodynamics of gas flows**	8

Ciphers DRN	Types and topics of training sessions	The volume of components, *hours*
	Types of gas flow and equation of continuity; first law of thermodynamics for gas flow and the basic shape of his writing; laws zvuzhuvalne leakage of gas through the nozzle; Combined Laval nozzle - purpose, construction, features leakage of gas; effect of friction on the parameters of the gas when it leaks; throttling of gases and vapors; Mixing gas flows	
SR4-F7-5	**8 Elementary methods of heat transfer and their laws**	6
	Thermal conductivity - the basic law of heat conduction, the calculation of heat flow through a homogeneous and stratified squamous and cylindrical wall; convective heat transfer - common concepts and definitions, the magnitude of the heat flux, the factors that affect heat transfer coefficient, hydrodynamic and thermal boundary layers using similarity theory in the study of the processes of heat transfer equation similarity calculation process engineering methods when forced heat and the free movement of fluids; thermal radiation - general, the types of radiant flux, the basic laws of radiant heat transfer, radiation heat transfer between solids, heat shields, heat radiation emissions	
SR4-F7-6	**9 Heat transfer processes**	4
	Advanced heat exchange process heat transfer, determination of the heat flow in the heat transfer through flat and cylindrical wall heat transfer coefficient and its thermal resistance, intensification of processes of heat transfer, thermal insulation	
	PRACTICAL TRAINING	17
SR4-F7-1	The basic thermodynamic parameters of their unit of measurement, measurement methods and measuring equipment	4
	The calculations of basic parameters of gases and mixtures thereof	
SR4-F7 -2	Calculation of gas thermodynamic processes	4
SR4-F7-3	Defining the steam parameters and its thermal parameters tables and diagrams	2
	Calculations steam thermodynamic processes	
SR4-F7-4	Payments processes leakage of gas through the nozzle zvuzhuvalne at subcritical and critical modes; calculation process leaks through the nozzle Laval	2
SR4-F7-5	Calculation of heat flows through the flat and cylindrical wall; determination of the heat flux heat when forced and free movement of coolant	2
SR4-F7-6	Calculation of heat flow heat transfer through the cylindrical wall, the choice of insulation material	3
	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	determining the average results of intermediate

practical	control tasks for each topic	tasks during practical classes	(CCW)	controls;
	or individual task	tasks during independent work		CCW performance during the examination at the request of the student

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		
♦ 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		
♦ 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: - 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	70-73

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
	four requirements	
	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		
♦ report to specialists and non-specialists of information, ideas, problems, solutions and their experience in the field of professional activity; ♦ the ability to form an effective communication strategy	- Fluent problematic area. Clarity response (report). Language - correct; - - net; - - clear; - - accurate; - - logic; - - expressive; - - concise. 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	95-100
	Adequate ownership industry issues with minor faults. Sufficient clarity response (report) with minor faults. Appropriate communication strategy with minor faults	90-94
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total three requirements are not implemented)	85-89
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (a total of four requirements is not implemented)	80-84
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total not implemented the five requirements)	74-79
	Satisfactory ownership issues of the industry. Satisfactory clarity response (report) and relevant communication strategy (a total of seven requirements not implemented)	70-73
	Partial ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented nine requirements)	65-69
	The fragmented ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented 10 requirements)	60-64
	The level of poor communication	<60
Autonomy and responsibility		
♦ management actions or complex projects,	- Excellent individual ownership management competencies focused on:	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
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	1) management of complex projects, providing: - 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: - justify their decisions the provisions of the regulatory framework of sectoral and national levels; - independence while performing tasks; - lead in discussing problems; - responsibility for the relationship; 3) responsible for the professional development of individuals and/or groups that includes: - 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: - 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. MV Holomenyuk "Thermodynamics and Heat Transfer" teach. guidances. / NV Holomenyuk; Nat. Sc. Univ. "Dnepr Polytechnic". - DA: NTU "SE", 2019. - 280 p.

2. Thermodynamics and Heat Transfer. Calculated objectives and methods of its solution for students of 185 oil and gas engineering and technology / MV Holomenyuk; Nat. Sc. Univ. "Dnepr Polytechnic". - DA: NTU "SE", 2019. - 20 p.

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