

Ministry of Education and Science of Ukraine

Dnipro University of Technology

Faculty of Mechanical Engineering

Department of structural, theoretical and applied mechanics

“APPROVED”

Head of Department

Kolosov D.L. _____

« ____ » _____ 2019

WORK PROGRAM OF ACADEMIC DISCIPLINE

“Technical mechanics and strength of materials”

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
Type of discipline.....	regulatory
Total workload.....	5 ECTS credits (150 hours)
Type of final assessment.....	exam
Period of study.....	3rd semester
Language of study.....	English

Lecturers: Kolosov D.L., Kiba V.Ya.

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

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

Dnipro
NTU “DP”
2019

Work program of the academic discipline “Technical mechanics and strength of materials” for bachelors of specialty 185 “Oil and Gas Engineering and Technology” /D.L. Kolosov, V.Ya. Kiba/ NTU “Dnipro Polytechnic”, Department of Structural, theoretical and applied mechanics – DA: NTU “DP” 2019 - 12 p.

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The work program regulates:

- key goals and objectives;
- disciplinary learning outcomes generated through transformation of intended learning outcomes of the degree program;
- basic disciplines;
- discipline program (thematic plan by different types of classes);
- distribution of 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 academic achievements of applicants by discipline;
- contents of educational and methodological support of the discipline.

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.

Approved by the decision of the Methodical Commission of specialty 185 “Oil and Gas Engineering and Technology” (protocol 6, 07.06.2019).

Recommended for publication by the editorial board of NTU DP (protocol 7, 07.05.2019).

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1 DISCIPLINE OBJECTIVE

Distribution of program learning outcomes (NRN) for organizational forms of the educational process is performed in educational and professional programs of the Dnipro University of Technology for specialty 185 “Oil and gas engineering and technology”. In particular, the following learning outcomes are attributed to the discipline F25 “Technical mechanics and strength of materials”.

SR5	Use mathematical methods for determining specific values of technological parameters of oil and gas wells, systems of oil and gas treatment, industrial and major oil and gas pipelines, oil and gas storages, and other elements of a system of oil and gas supply.
SR7	Analyze a technical condition of elements of technological equipment of systems of extraction, transportation, and storage of oil and gas using the methods based on materials science and mechanics of machines.
SR8	Use main methods of analysis and estimation of a condition of elements of oil and gas objects using means of technical diagnosis in industrial and laboratory conditions.

Discipline objective is formation of competencies regarding the following:

- basic concepts and principles of calculating strength, rigidity, and stability of elements of structures considering their safety and economy;
- contribute to development of logical and analytical thinking in students during construction of physical and mathematical models of operation of elements and parts of structures, formulation and solution of problems of technical mechanics and strength of materials.

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

NRN Code	Disciplinary learning outcomes (DRN)	
	DRN code	content
F25	SR5-F25-1	Know basic relations and equations of technical mechanics and strength of materials and be able to use them to determine structural and technological parameters of equipment for extraction, transportation and storage of oil and gas
	SR7-F25-1	Estimate and calculate strength and rigidity of components of oil and gas equipment under tension, compression, torsion and bending. Perform drill string stability calculations
	SR8-F25-1	Be familiar with basic methods of analysis and evaluation of a condition of elements of oil and gas objects and perform their static, kinematic and dynamic calculations

3 BASIC DISCIPLINES

Discipline	Acquired learning outcomes
B1 Higher mathematics	Apply theories, principles, methods and concepts of basic and general engineering sciences during studying and professional activity

Discipline	Acquired learning outcomes
B3 Physics	Use basic concepts, basic laws of physics and chemistry to predict and analyze physical and chemical properties of oil, condensate and natural gas in a processes of their extraction, drilling of wells, transportation and storage
B4 Engineering graphics	Apply modern software for design and operational calculations of parameters of technological processes of extraction, drilling of wells, transportation and storage of oil and gas

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

Type of classes	Workload 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)
lectures	75	26	49	-	-	8	67
practical	75	26	49	-	-	6	69
laboratory	-	-	-	-	-	-	-
workshops	-	-	-	-	-	-	-
TOTAL	150	52	98	-	-	14	136

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

DRN code	Types and topics of training sessions	Volume of components, hours
	LECTURES	80
SR5-F25-1 SR7-F25-1 SR8-F25-1	1 Technical mechanics	45
	Basics calculations in statics	
	Kinematics of mechanisms	
	Basics of dynamics of mechanisms and machines	
	Transfer mechanisms and basics of their calculation	
	2 Strength of materials	35
	Tension and compression	
	Torsion	
	Bending of straight beams	
Stability of rods		
	PRACTICAL	70
SR5-F25-1 SR7-F25-1 SR8-F25-1	1 Technical mechanics	45
	Equilibrium calculations of elements of oil and gas equipment	
	Determination of kinematic characteristics of oil and gas equipment	
	Examples of solutions of engineering problems of dynamics	
	Solution of problems of kinematics and dynamics of transfer mechanisms	35
	2 Strength of materials	
	Solution of tension, compression, twisting, and bending problems of strength and rigidity of elements of oil and gas equipment	

DRN code	Types and topics of training sessions	Volume of components, hours
	Stability calculation of drill strings	
	TOTAL	150

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 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 practical classes 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	85-89

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
	requirement	
	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		
<p>◆ report to specialists and non-specialists of information, ideas, problems, solutions and their experience in the field of professional activity;</p> <p>◆ the ability to form an effective communication strategy</p>	<p>- Fluent problematic area. Clarity response (report). Language - correct;</p> <ul style="list-style-type: none"> - - net; - - clear; - - 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>	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	65-69

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
	response (report) and communication strategy of faults (total not implemented nine requirements)	
	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		
<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: <ol style="list-style-type: none"> 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; - 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 	95-100
	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 BIBLIOGRAPHY

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