SYLLABUS OF THE ACADEMIC DISCIPLINE
"THEORETICAL MECHANICS"

Academic degree	Bachelor
Academic program	192 Building and Civil Engineering
Duration	2nd semester, 3,4 quarters
Classes:	2020 - 2021 years of study
Final control form	Exam
Language	English
Department	Dept. of Structural, Theoretical and Applied Mechanics

Distance course https://do.nmu.org.ua/course/view.php?id=1721

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1. Abstract of the course

THEORETICAL MECHANICS. The course covers issues that arise during the studies of fundamental disciplines in the field of knowledge 19 Architecture and Construction, namely: the study of mechanical motion and interaction of solid bodies. A general method of scientific research is that when considering a phenomenon the focus is drawn to the essential and crucial, and the other, concomitant, is abstracted from. As a result, instead of a real phenomenon or object, some model is considered and a number of abstract concepts are introduced that reflect the properties of a phenomenon or object. It is shown that the use of a simplified approach can contribute to application of acquired knowledge in calculations of real structures.

2. Purpose and objectives of the course

The Purpose of the Course is the formation of competencies on basic concepts and principles of formulation and solution of problems of mechanics, logical and analytical thinking of students during the construction of a physical and mathematical model of elements and parts of building structures.

Objectives of the Course are formation of theoretical knowledge and practical skills of future professionals in accordance with the Purpose; development of students' skills and abilities in solving practical problems, using the basic laws of theoretical mechanics; providing skills and knowledge necessary for mastering the general competencies of the

bachelor, which are regulated by the educational-professional program in the specialty 192 Construction and Civil Engineering

3. Learning outcomes

- Knowing the basic concepts of mechanics and research methods common to all areas of mechanics.
- Knowing and understanding the basic definitions, laws, theorems and principles of mechanics.
- Applying the skills of theoretical generalization of the acquired knowledge: using the general theorems of dynamics, or principles of mechanics in accordance with the condition of the problem under consideration.
- Applying a method of determining the forces acting in mechanical systems of solids; methods for determining the conditions of equilibrium of a structure and mechanical systems of solids.
- Being able to construct and solve equations of motion of a material point (or solid).
- Calculating the trajectory of a mechanical body at given forces.
- Identifying the forces acting on the links of mechanisms and various solids.
- Analyzing the result; performing verification calculations.

4. Course structure

LECTURES

1. Statics.

Basic concepts and axioms of statics.
Equilibrium conditions of a plane system of forces.
Equilibrium conditions of the spatial system of forces.
Center of gravity.

2. Kinematics.

Kinematics of a point
The simplest types of motion of solids. Determination of velocities and accelerations of points.
Plane-parallel body motion. Instantaneous center of velocity. Determination of velocities and accelerations of points.

3. Dynamics.

Dynamics of a Point. Direct and inverse dynamics problems. Differential equations of motion.
Basic theorems of dynamics.
Dynamics of a System.
Elements of analytical mechanics.

PRACTICAL CLASSES

1. Statics.

Equilibrium of convergent, planar and spatial system of forces. Determination of reactions of supports (graphical and analytical method)
Determination of the center of gravity of plane sections.

2. Kinematics.

Linear, rotational and plane-parallel motion of a rigid body (determination of velocities and accelerations of points).

3. Dynamics.
Integration of differential equations of point motion.
Application of basic theorems of dynamics.

5. Hardware and/or software

Technical means of learning.
Distance learning platform Moodle, MS Office 365.

6. Knowledge progress testing

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:

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

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 6th 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

<table>
<tr><td colspan="3">INTERMEDIATE CONTROL</td><td colspan="2">FINAL ASSESSMENT</td></tr>
<tr><td>training sessions</td><td>diagnostic tools</td><td>procedures</td><td>diagnostic tools</td><td>procedures</td></tr>
<tr><td>lectures</td><td>control tasks for each topic</td><td>task during lectures</td><td rowspan="3">comprehensive reference work (CCW)</td><td rowspan="3">determining the average results of intermediate controls;

CCW performance during the examination at the request of the student</td></tr>
<tr><td rowspan="2">practical</td><td>control tasks for each topic</td><td>tasks during practical classes</td></tr>
<tr><td>or individual task</td><td>tasks during independent work</td></tr>
</table>

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.

7. Course policy

7.1. Academic Integrity Policy.

Academic integrity of students is an important condition for mastering the results of training in the discipline and obtaining a satisfactory grade on the current and final tests. Academic integrity is based on condemnation of the practices of copying (writing with external sources other than those allowed for use), plagiarism (reproduction of published texts by other authors without indication of authorship), fabrication (fabrication of data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation "Regulations on the system of prevention and detection of plagiarism at the Dnipro University of Technology (http://www.nmu.org.ua/ua/content/activity/us_documents/System_of_prevention_and_detection_of_plagiarism.pdf.)

In case of violation of academic integrity by a student (copying, plagiarism, fabrication), the work is evaluated unsatisfactorily and must be repeated. The teacher reserves the right to change the topic of the task.

7.2. Communication policy.

Students must have activated university mail.

It is the student's responsibility to check the mailbox at Office365 once a week (every Sunday).

During the weeks of independent work it is the student's responsibility to work with the distance course "Theoretical Mechanics" (www.do.nmu.org.ua)

All written questions to teachers regarding the course should be sent to the university e-mail.

7.3. Reassembly policy.

Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Relocation takes place with the permission of the dean's office if there are good reasons (for example, sick leave).

7.4. Attending classes.

Full-time students are required to attend classes. Good reasons for not attending classes are illness, participation in university events, business trips, which must be confirmed by documents in case of prolonged (two weeks) absence. The student must inform the teacher either in person or through the headmaster about the absence from class and the reasons for absence. If a student is ill, we recommend staying home and studying with a distance platform. Students whose health is unsatisfactory and may affect the health of other students will be encouraged to leave the class (such absence will be considered an absence due to illness). Practical classes are not repeated, these assessments cannot be obtained during the consultation. For objective reasons (for example, international mobility), learning can take place remotely - online, in agreement with the teacher.

7.5 Evaluation Appeal Policy.

If the student does not agree with the assessment of his knowledge, he may appeal the assessment made by the teacher in the prescribed manner.

7.6. Bonuses.

Students who regularly attended lectures (have no more than two passes without good reason) and have a written syllabus of lectures receive an additional 2 points to the results of the assessment to the final grade.

7.7. Participation in the survey.

At the end of the course and before the session, students will be asked to fill out anonymously questionnaires (Microsoft Forms Office 365), which will be sent to your university mailboxes. Completing the questionnaires is an important component of your learning activity, which will allow you to assess the effectiveness of the teaching methods used and take into account your suggestions for improving the content of the course "Theoretical Mechanics".

8. Information resources

1. Dolgov, A.M. Theoretical Mechanics. Dynamics [Text] tutorial / A.M. Dolgov. - D.: National Mining University, 2012. - 160 p.
2. Dolgov, A.M. Theoretical mechanics [electronic resourse] : electronic textbook / A.M. Dolgov ; Ministry of Education and Science of Ukraine, National Mining University. Dnipropetrovs'k : NMU, 2015. - 124 p.
3. Problems of Statics/ Compiled by A.M. Dolgov. D.: Dnipro University of Technology, 2018.
4. Problems of Kinematics / Compiled by A.M. Dolgov. D.: Dnipro University of Technology, 2018.
5. Problems of Dynamics / Compiled by A.M. Dolgov. D.: Dnipro University of Technology, 2018.
6. Theoretical Mechanics A Short Course. - Moskow.: Mir, 1988. – 416 p.