SYLLABUS OF THE ACADEMIC DISCIPLINE
"STRUCTURAL MECHANICS"

Academic degree	Bachelor
Academic program	192 Building and Civil Engineering
Duration	4th semester, 7,8 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=3091

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1. Abstract of the course

STRUCTURAL MECHANICS it is the science of strength of structural elements and buildings. The course covers issues that arise during the studies of fundamental disciplines for the field of knowledge 19 Architecture and Construction. Structures under the influence of external load are considered, which change their shape and size, i.e. deform.

2. Purpose and objectives of the course

The Purpose of the Course is the formation of competencies on basic concepts, principles and calculation methods during strength, rigidity, stability and endurance calculations of elements of structures considering their reliability and economy, promoting the development of logical and analytical thinking in students during construction of physical and mathematical models of elements or parts of structures, setting and solving construction problems.

Objective of the Course is to ensure reliable cross-sectional dimensions of structural elements and structures that are subject to external loads. Such dimensions are determined based on strength, rigidity and stability of a structural element. When calculating the strength, dimensions of a cross-section are determined from the conditions of excluding a possibility of destruction under the action of external load.

3. Learning outcomes

- Knowing the methods of calculation of statically determinate structures

- Using methods of solving the statically indeterminate elements of structures
- Being able to perform strength and rigidity calculations of the elements of structures
- Justifying the decision on selection of a rational profile and material of elements of structures
- Knowing the algorithm and procedure for applying the method of experimental determination of material constants and its main mechanical characteristics.
- Applying the methods of strength, rigidity and stability calculations for the elements of machines and structures based on the basic laws of classical mechanics, corresponding to the current state of knowledge in the mechanics of deformed solids.
- Being able to calculate the strength, rigidity of the rod elements of structures with simple and complex types of deformation.
- Being able to design a mathematical model (calculation scheme) of a real object; find and apply calculation methods.
- Knowing the algorithms and procedures for applying methods to detect static uncertainty of rod systems.

4. Course structure

LECTURES

1. Statically determinate problems

Strength calculation of statically determinate plane frames
Calculations of trusses using methods of node cutting and Ritter
Calculation of arches under the action of concentrated forces and distributed load
Strength calculation of the arch with a distributed load
Strength calculation of 3 hinged arches
Eccentric tension-compression

2. Statically indeterminate problems

Calculation of long-span beams
Potential energy of elastic deformation of plane structures
Castigliano's theorem
Mohr’s integral to determine displacements in elastic structures
Calculation of displacements of points of frames and arches
Force method. Canonical equations of the method of forces
Solving statically indeterminate problems using the energy method

PRACTICAL CLASSES

Example of calculation of a plane statically determinate frame
Example of static calculation of a plane truss
Examples of solving statically indeterminate problems using the method of forces
Example of application of Mohr’s integral to calculate the curved axis of the arch
Examples of solving statically indeterminate problems using the energy method
Example of calculation of statically indeterminate beam
Example of calculation of a multi-span beam
Example of calculation of the arch under the action of concentrated forces and distributed load
Example of calculating the strength of a statically indeterminate frame
Example of strength calculation of the beam under the eccentric tension-compression

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 "Structural 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 "Structural Mechanics".

8. Information resources

1. Structural Mechanics / A. Darkov, V. Kuznetsov. – Moscow: Mir, 1966. – 710 p.
2. Architectural Structures / G. Schierle. – Los Angeles: University of Southern California: 2006. – 227 p.

3. Баженов В.А. Будівельна механіка. Розрахункові вправи. Задачі. Комп'ютерне тестування : Навчальний посібник / В.А. Баженов, Г.М. Іванченко, О.В. Шишов, С.О. Пискунов. – К.: 2013. – 439 С. [in Ukrainian]
4. Strength of Materials. Textbook. Illustrative Material / A.M. Dolgov. - D.: National Mining University, 2015. - 68 p.
5. Strength of Materials / N.M. Belyaev. – M.: Mir Publishers, 1979. – 648 p.
6. Писаренко Г.С. Strength of Materials: Textbook / Г.С. Писаренко, О.Л. Квітка, Е.С. Уманський; За ред. Г.С. Писаренка. – 2-ге вид., допов. і переробл. – К.: Вища шк., 2004. – 655 С. [in Ukrainian]
7. Александров А.В. Strength of Materials: Textbook for Universities/ А.В. Александров, В.Д. Потапов, Б.П. Державин; Под ред. Александрова А.В. – 3-е изд. испр. – М.: Высш. шк., 2003. – 560 с. [in Russian]
8. Степин П.А. Strength of Materials: Учеб. для немашиностроит. спец. вузов. – 9-е испр. – М.: Интеграл-Пресс, 1997. – 320 с. [in Russian]