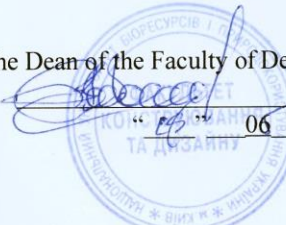


**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF  
UKRAINE**  
Department of Mechanics


  
by the Dean of the Faculty of Design and Engineering  
Ivan ROGOVSKII  
2026

**APPROVED**

**APPROVED**  
at the meeting of the Department of Mechanics  
Minutes No. 9 of "27" may 2026  
Head of the Department  
Volodymyr BULGAKOV

**REVIEWED**  
Guarantor of the AP Building and civil engineering  
Evhen DMYTRENKO

**CURRICULUM OF ACADEMIC DISCIPLINE**  
**0k 14 Mechanics of materials and constructions**

Area of knowledge      G "Architecture and Construction"  
Specialty                 G19 "Building and civil engineering"  
Academic programme    Building and civil engineering  
Faculty                    Faculty of Design and Engineering  
Developed by: Assoc. Prof. of Department of Mechanics, Ph. D. of Physical and  
Mathematical Sciences, Assoc. Prof.  Anastasiia KUTSENKO

Kyiv – 2026

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF  
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Engineering

“\_\_\_\_\_” \_\_\_\_\_ 2026

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Kyiv – 2026

Description of the discipline **Mechanics of materials and constructions**

(name)

<b>Academic degree, specialty, academic programme</b>			
Academic degree	Bachelor		
Specialty	G "Architecture and construction"		
Academic programme	G19 " Building and engineering of the city"		
<b>Characteristics of the discipline</b>			
Type	compulsory		
Total number of hours	180		
Number of ECTS credits	6		
Number of modules	5		
Course project (work) (if any)	1		
Form of assessment	<i>credit / exam</i>		
<b>Indicators of the discipline for full-time and part-time forms of university study</b>			
	Full-time		Part-time
Year of study	2		2
Semester	3	4	
Lectures	30 hours.	30 hours.	
Practical classes and seminars	30 hours.	30 hours.	
Laboratory classes	-.	-	
Self-study	30 hours.	15 hours.	
Coursework	15 hours.		
Number of hours per week for full-time students	4 hours	4 hours	

**1. Aim, objectives, competences and expected learning outcomes of the discipline**

Aim is skills of solving problems of Mechanics of materials and structures and laying the basis for the study subjects: "Structural mechanics", "Concrete and masonry structures", "Metal and wooden structures".

Objectives are the study of the methods of calculation of structures for strength, rigidity and stability; the study of the stress-strain state of the beam at tension and compression, at direct shear, at torsion and at bend.

**List of prerequisites:** 0k1 "Physics", 0k2 "Descriptive Geometry and Engineering Graphics", 0k3 "Higher Mathematics", 0k9 "Mathematical Modeling and Computer Technologies".

**Acquisition of competences:**

Integral competence (IC):

IC. It is the ability to solve complex specialized problems of construction and civil engineering in the learning process, which involves the application of a complex of



1	2	3	4	5	6	7	8	9	10	11	12	13	14
Topic 3. The method of calculating the bar on strength	3	8	2	4		2							
Topic 4. The method of calculating the bar on rigidity	4	6	2	2		2							
Topic 5. The first moment of area	5	8	2	2		4							
Total of module 1		30	10	10		10							
<b>Module 2: Torsion</b>													
Topic 1. The geometric characterizations of the plane cross sections.	6	6	2	2		2							
Topic 2. The geometric characterizations of the plane cross sections.	7	4	2	2									
Topic 3. The direct shear stresses.	8	6	2	2		2							
Topic 4. The definition of torsion.	9	6	2	2		2							
Topic 5. The method of calculating the bar on strength and rigidity by torsion	10	8	2	2		4							
Total of module 2		30	10	10		10							
<b>Module 3: Beam bending</b>													
Topic 1. The equation of Shearing force for the cantilever and simple beams	11	6	2		2	2							
Topic 2. The equation of Bending moment for the cantilever and simple beams.	12	6	2		2	2							
Topic 3. The calculation method cantilever beam on the strength by the normal stresses	13	6	2		2	2							

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Topic 4. The calculation method simple beam on the strength by the normal stresses.	14	6	2		2	2							
Topic 5. The calculation method simple beam on the strength by the normal stresses.	15	6	2		2	2							
Total of module 3		30	10		10	10							
Total for Semester 3		90	30		30	30							
<b>Module 4. Methods of defining of beam deformations</b>													
Topic 1. Double – integration method.	1	6	2		2								
Topic 2. Verescagin’s rule.	2	6	2		2	2							
Topic 3. Castigliano’s theorem.	3	4	2		2	2							
Topic 4. The construction method of the diagram of shear-force and bending-moment for the cantilever frame	4	4	2		2								
Topic 5. The construction method of the diagram of shear-force and bending-moment for the simple frame.	5	4	2		2								
Topic 6. The curved beam.	6	6	2		2	2							
Topic 7. The definitions of the statically indeterminate constructions.	7	4	2		2								
Topic 8. The application of the Castigliano’s theorem to the statically indeterminate constructions.	8	4	2		2								
Total of module 4		38	16		16	6							

1	2	3	4	5	6	7	8	9	10	11	12	13	14
<b>The thematic module 5: The complex deformations</b>													
Topic 1. The three moment's theorem.	9	4	2		2								
Topic 2. The application of the Verescagin's rule to the statically indeterminate constructions.	10	5	2		2	1							
Topic 3. Analysis of Stress and Strain in the case of the action of compression and bending at one time	11	6	2		2	2							
Topic 4. Analysis of Stress and Strain in the case of the action of tension and bending at one time	12	6	2		2	2							
Topic 5. Analysis of Stress and Strain in the case of the action of two bending moments at one time, which acting in perpendicular planes	13	6	2		2	2							
Topic 6. The calculation method of column.	14	6	2		2	2							
Topic 7. Analysis of Stress and Strain in the case of the action of bending and torsion at one time.	15	6	2		2								
Total of module 5		37	14		14	9							
Total for Semester 4		75	30		30	15							
Total hours		165	60		60	45							

### 3. Topics of Lectures

№	Topic title	Hour numbers
3 semester		
1	Purpose and objectives of the course. The basic hypotheses and the definitions of the mechanics of materials and constructions.	2
2	The relation among internal forces and tensions in case of tension or compression of the bar.	2

3	The method of calculating the bar on strength	2
4	The method of calculating the bar on rigidity	2
5	The first moment of area	2
6	The geometric characterizations of the plane cross sections.	2
7	The geometric characterizations of the plane cross sections.	2
8	The direct shear stresses.	2
9	The definition of torsion.	2
10	The method of calculating the bar on strength and rigidity by torsion	2
11	The equation of Shearing force for the cantilever and simple beams	2
12	The equation of Bending moment for the cantilever and simple beams.	2
13	The calculation method cantilever beam on the strength by the normal stresses	2
14	The calculation method simple beam on the strength by the normal stresses.	2
15	The calculation method simple beam on the strength by the normal stresses.	2
4 semester		
16	Double – integration method.	2
17	Verescagin’s rule.	2
18	Castigliano’s theorem.	2
19	The construction method of the diagram of shear-force and bending-moment for the cantilever frame	2
20	The construction method of the diagram of shear-force and bending-moment for the simple frame.	2
21	The curved beam.	2
22	The definitions of the statically indeterminate constructions.	2
23	The application of the Castigliano’s theorem to the statically indeterminate constructions.	2
24	The three moment’s theorem.	2
25	The application of the Verescagin’s rule to the statically indeterminate constructions.	2
26	Analysis of Stress and Strain in the case of the action of compression and bending at one time	2
27	Analysis of Stress and Strain in the case of the action of tension and bending at one time	2
28	Analysis of Stress and Strain in the case of the action of two bending moments at one time, which acting in perpendicular planes	2
29	The calculation method of column.	2
30	Analysis of Stress and Strain in the case of the action of bending and torsion at one time.	2

#### 4. Topics of Practical classes

№	Topic title	Hour numbers
3 semester		
1	The calculation of the bar on strength.	2
2	The calculation of the bar on rigidity.	2
3	The geometric characterizations of the plane cross sections.	6
4	The direct shear stresses.	2
5		2
6	The method of calculating the bar on strength and rigidity by torsion.	2
7	The construction of diagram of Shearing force for the cantilever and simple beams.	2
8	The construction of diagram of Bending moment for the cantilever and simple	2

	beams.	
9	The calculation of cantilever beam on the strength by the normal stresses.	4
10	The calculation of simple beam on the strength by the normal stresses.	4
4 semester		
1	The calculation of beam strain by Verescagin's rule.	2
2	The calculation of beam strain by the method of initial parameters.	2
3	The calculation of beam strain by the Castigliano's theorem.	2
4	The construction of the diagrams of shear-force and bending-moment for the cantilever frame	2
5	The construction of the diagrams of shear-force and bending-moment for the simple frame.	2
6	The curved beam.	2
7	The definitions of the statically indeterminate constructions.	2
8	The application of the Castigliano's theorem to the statically indeterminate constructions.	4
9	The three moment's theorem.	2
10	The application of the Verescagin's rule to the statically indeterminate constructions.	4
11	The calculation of column.	2
12	The calculation of beam in the case of at one time action of bending and torsion.	4

### 5. Topics for self-study

№	Topic title	Hour numbers
3 semester		
1	The calculation of the bar on strength and rigidity.	4
2	The geometric characterizations of the plane cross sections.	8
3	The direct shear stresses.	2
4	The method of calculating the bar on strength and rigidity by torsion.	6
5	The calculation of cantilever beam on the strength by the normal stresses.	5
6	The calculation of simple beam on the strength by the normal stresses.	5
4 semester		
1	The calculation of beam strain by Verescagin's rule.	2
2	The calculation of beam strain by the Castigliano's theorem.	2
3	The curved beam.	2
4	The application of the Verescagin's rule to the statically indeterminate constructions.	1
5	Analysis of Stress and Strain in the case of the action of compression and bending at one time	2
6	Analysis of Stress and Strain in the case of the action of tension and bending at one time	2
7	Analysis of Stress and Strain in the case of the action of two bending moments at one time, which acting in perpendicular planes	2
8	The calculation method of column.	2

## 6. Tools for assessing expected learning outcomes:

- exam;
- credit;
- module tests;
- graphic design works; presentation of laboratory and practical works;
- other types.

## 7. Teaching methods:

- verbal method (lecture, discussion, interview, etc.);
- practical method (laboratory, practical classes);
- visual method (illustration, demonstration);
- video method (remote, multimedia, web-based, etc.);
- self-study (completing assignments);
- individual research work;

## 8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

### 8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
3 semester		
<b>Module 1. Tension and compression</b>		
Practical work 1.	ELO 2, 7, 17.	<b>8</b>
Practical work 2.	<b>Student should be know:</b> the basic hypotheses and the definitions of the mechanics of materials and constructions <b>Student should be able to:</b> built the diagrams of internal forces and tensions in case of tension or compression of the bar.	<b>8</b>
Practical work 3.		<b>8</b>
Practical work 4.		<b>8</b>
Practical work 5.		<b>8</b>
Module work 1.		<b>20</b>
Module work 2.		<b>30</b>
Testing Module 1		<b>10</b>
<b>Total for module 1</b>		<b>100</b>
<b>Module 2. Torsion</b>		
Practical work 6.	ELO 2, 7, 17.	<b>5</b>
Practical work 7.	<b>Student should be know:</b> the main geometric characterizations of the plane cross sections; the relation among internal forces and tensions in cases of direct shear and torsion. <b>Student should be able to:</b> built the diagrams of internal forces and tensions in case of torsion of the bar.	<b>5</b>
Practical work 8.		<b>5</b>
Practical work 9.		<b>5</b>
Practical work 10.		<b>5</b>
Module work 3.		<b>25</b>
Module work 4.		<b>30</b>
Testing Module 2		<b>20</b>
<b>Total for module 2</b>		<b>100</b>

<b>Module 3. Beam bending</b>		
Practical work 11.	ELO 2, 7, 17.	<b>10</b>
Practical work 12.	<b>Student should be know:</b> the equations of bending moment and shearing force for the cantilever and simple beams. <b>Student should be able to:</b> built the diagrams of internal forces and tensions in case of bending of the beam.	<b>10</b>
Practical work 13.		<b>5</b>
Practical work 14.		<b>10</b>
Practical work 15.		<b>10</b>
Module work 5.		<b>20</b>
Module work 6.		<b>25</b>
Testing Module 3		<b>10</b>
<b>Total for module 3</b>		<b>100</b>
<b>Class work</b>	<b><math>(M1 + M2 + M3)/3 * 0,7 \leq 70</math></b>	
<b>Credit</b>	<b>30</b>	
<b>Total for 3 semester</b>	<b><math>(\text{Class work} + \text{credit}) \leq 100</math></b>	
Course project/work		<b>100</b>
4 semester		
<b>Module 4. Methods of defininding of beam deformations</b>		
Practical work 16.	ELO 2, 7, 17.	<b>10</b>
Practical work 17.	<b>Student should be know:</b> the basis methods for definition the deformations of beam and frame. The definitions of the statically indeterminate constructions; the three moment's theorem. <b>Student should be able to:</b> define the deformations of beam and frame by different methods.	<b>10</b>
Practical work 18.		<b>10</b>
Practical work 19.		<b>10</b>
Practical work 20.		<b>12</b>
Practical work 21.		<b>12</b>
Practical work 22.		<b>12</b>
Practical work 23.		<b>12</b>
Testing Module 4	<b>12</b>	
<b>Total for module 4</b>		<b>100</b>
<b>Module 5. The complex deformations</b>		
Practical work 24.	ELO 2, 7, 17.	<b>15</b>
Practical work 25.	<b>Student should be know:</b> Stress and Strain in the case of the action of complex deformations of construction. <b>Student should be able to:</b> calculate beam and frame by acting of complex Stress and Strain.	<b>5</b>
Practical work 26.		<b>5</b>
Practical work 27.		<b>5</b>
Practical work 28.		<b>5</b>
Practical work 29.		<b>5</b>
Practical work 30.		<b>10</b>
Module work 7.		<b>30</b>
Testing Module 5	<b>20</b>	
<b>Total for module 5</b>		<b>100</b>
<b>Class work</b>	<b><math>(M4 + M5)/2 * 0,7 \leq 70</math></b>	
<b>Exam</b>	<b>30</b>	
<b>Total for 4 semester</b>	<b><math>(\text{Class work} + \text{exam}) \leq 100</math></b>	

## 8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

## 8.3. Assessment policy

<b>Deadlines and exam retaking rules</b>	<i>EXAMPLE:</i> works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
<b>Academic integrity rules</b>	<i>EXAMPLE:</i> cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
<b>Attendance rules</b>	<i>EXAMPLE:</i> Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

## 9. Teaching and learning aids

1. e-learning course of the discipline
  - <https://elearn.nubip.edu.ua/course/view.php?id=3933>;
  - <https://elearn.nubip.edu.ua/course/view.php?id=3934>;
2. Mechanics of materials and constructions. Methodic instructions for course work for students of the Faculty of Construction and Design // A. Kutsenko, M Bondar, V. Yaremenko – Kyiv. 2025 – 177 p.

## 10. Recommended sources of information

1. Silberschmidt, V., Hearn, E. J. Mechanics of Materials: An Introduction to the Mechanics of Elastic and Plastic Deformation of Solids and Structural Materials (4th ed.). Elsevier, 2026 – 858 p.
2. John C.J., Ross C.T.F.: Strength of Materials and Structures. Arnold. – 719 p.
3. R. C. Hibbeler. Mechanics of Materials. The 7<sup>th</sup> Edition.pdf, 2022– 1724 p.  
<https://drive.google.com/file/d/0Bx1MM7wb0GgSR2tjV1lrVHpDTEU/view?resourcekey=0-DD5wLrtza9II5b-rwDPHqg>
4. Sharma S.C.: Strength\_of\_materials. Web Course.  
<http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IITROORKEE/strength%20of%20materials/homepage.htm>
5. Educational videos of mechanics of materials  
<https://www.bing.com/videos/search?q=mechanics+of+material+PDF&qpv=mechanics+of+material+pdf&FORM=VDRE>