(F 03.02 – 110)

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY
Faculty of Architecture, Civil Engineering and Design
Computer Technologies of Airport Construction and Reconstruction Department

AGREED
Dean of the Faculty
_____ Viktor KARPOV
«26» 10 2022

APPROVED
Vice Rector for Academics
_____ Anatolii POLUKHIN
«28» 10 2022

Quality Management System

COURSE TRAINING PROGRAM
on
"Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory"

Educational-Professional Program: "Industrial and Civil Engineering"
Field of study: 19 "Architecture and Construction"
Specialty: 192 "Building and Civil Engineering"

Form of training	Sem.	Total (hours/ ECTS credits))	Lec.	Prac.	Lab.	Self-study	Homeworks, control (home) works	CP/ TP	Form of control
Full-time	4	165/5,5	34	-	34	97	–	CP-4s	Graded Test 4th semester

Index: ECB-5 - 192 - 1/22 - 2.1.22

The Course Training Program on "Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory" is developed on the basis of the Educational-Professional Program "Industrial and Civil Engineering", Bachelor Curriculum and Extended Curriculum №СВ-5-192-1/21, and № ECB-5-192-1/21, for training higher education seekers of the Bachelor degree of specialty 192 "Building and Civil Engineering" and corresponding normative documents.

Developed by:

Professor of the Department of Computer technologies of construction and reconstruction of and airports, Doctor of Technical Sciences _____ Nataliia MAKHINKO

Associate professor of the Computer Technologies of Airport Construction and Reconstruction Department _____ Oleksandr HORB

Discussed and approved by the Graduate Department for the Specialty 192 "Building and Civil Engineering" (Educational Professional Program "Industrial and Civil Engineering") – Computer Technologies of Airport Construction and Reconstruction Department, Minutes №2 of October, 25, 2022.

Head of the Department _____ Oleksandr LAPENKO

Guarantor of the Educational and Professional Program _____ Nataliia KOSTYRA

Vice Rector on International Collaboration and Education

_____ Iryna ZARUBINSKA

«27» 10 2022

Level of document – 3b
Planned term between revisions – 1 year
Control copy

CONTENTS

INTRODUCTION

The Course Training Program of the academic discipline "Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory" was developed on the basis of the "Methodological recommendations for the development and execution of the syllabus of educational discipline of full-time and part-time forms of training", approved by rector's order No. 249/roz. of 29.04.2021 and relevant regulatory documents.

1. EXPLANATORY NOTE

1.1. Role, goal and objectives of the academic discipline

The discipline "Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory" occupies a leading place in the process of professional training of a higher education applicant, as it creates the basis for the formation of engineering thought, thinking and intuition and provides a theoretical level of knowledge and practical skills of a specialist in the field of construction of buildings and structures. Studying the course of this discipline is aimed at obtaining knowledge that forms the profile of a specialist in the field of resistance of building structures of buildings and structures.

The goal of teaching the discipline is to master and actively learn the basic methods of the theory of elasticity and plasticity, reliability and fracture mechanics in a systematic form when solving problems to determine the stress-strain state of structures in the spectrum of practical problems studied at the level of a bachelor of civil engineering.

The objectives of the discipline are:

- mastering the basic theoretical provisions of the discipline "Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory", calculation formulas and their limits of applicability, scientific and technical terminology, physical quantities and units of measurement;
- study of methods of calculation for strength, stiffness and stability of structural elements and structures that correspond to the current state of knowledge in the theory of elasticity and plasticity;
- acquiring skills in experimental research on the strength of materials and explaining the physical nature of their destruction
- ability to analyze the numerical results of theoretical and experimental studies.

1.2. Educational outcomes of the academic discipline

As a result of studying the discipline, the higher education applicant forms a set of knowledge in the field of engineering calculations for simple and complex resistance to strength, stiffness and stability of structural elements that provide the

necessary reliability and safety of building structures under the influence of static and dynamic loads. The program learning outcomes are:

PLO2 – Participate in research and development in the field of architecture and construction. PLO5 – Use and develop technical documentation at all stages of the life cycle of construction products. PLO7 – Perform data collection, interpretation and application, including through the search, processing and analysis of information from various sources. PLO11 – Demonstrate an understanding of the design principles of urban areas and infrastructure. PLO12 – Have in-depth cognitive and practical skills/attainments, mastery and innovation at the level necessary to solve complex specialized tasks in the field of construction and civil engineering. PLO17 – Mastering work skills to work effectively independently (course and diploma design) or in a group (laboratory classes, including leadership skills in their implementation), the ability to obtain the desired result in a limited time with an emphasis on professional integrity and the exclusion of plagiarism.

1.3. Competencies obtained through the academic discipline

According to the content of the discipline, a higher education student must be able to analyze the deformed and stressed state of structural elements and practically apply the basics of the theory of elasticity and plasticity to solve problems that correspond to the professional activities of a specialist in the design and calculation of buildings and structures.

IC. The ability to solve complex specialized tasks and practical problems in the field of construction or in the learning process, which involves the application of theories and methods of determining the strength, stability, durability, reliability and safety of buildings and structures; application of information technologies, software complexes, automated design systems.

General competencies that the discipline enables you to acquire:

GC1 – Ability to think abstractly, analyze and synthesize. GC2 – Knowledge and understanding of the subject area and professional activity. GC3 – Ability to communicate in the state language both orally and in writing. GC5 – Ability to use information and communication technologies. GC6 – Ability to independently acquire knowledge by searching, processing and analyzing in-formation from various sources. GC7 – Interpersonal skills.

Professional competencies that the discipline enables you to acquire:

PC1 – Ability to use conceptual scientific and practical knowledge of mathematics, chemistry and physics to solve complex practical problems in construction and civil engineering. PC3 – Ability to design building structures,

buildings, structures and engineering networks (according to specialization), taking into account engineering and resource-saving measures, legal, social, environmental, technical and economic indicators, scientific and ethical aspects, and modern requirements of regulatory documentation in the field of architecture and construction, environmental protection and labor safety. PC6 – Ability to perform engineering activities in the field of construction, compilation and use of technical documentation. PC7 – Ability to take responsibility for developing and making decisions in the field of architecture and construction in unpredictable work contexts.

1.4. Interdisciplinary links

The discipline "Mechanics of Materials (Special Course) and Fundamentals of Plasticity and Elasticity Theory" is based on the knowledge of such disciplines as "Higher Mathematics", "Theoretical Mechanics (Statics)", "Introduction to Civil Engineering" and is the basis for the study of further disciplines, namely: "Building structures", "Metal structures", "Structural mechanics (special course)", "Foundation Engineering".

2. PROGRAM OF THE ACADEMIC DISCIPLINE

2.1. Content of the academic discipline

The educational material of the discipline is structured on a modular basis and consists of **two educational modules**, namely:

- training module №1 "Fundamentals of the theory of elasticity";
- module 2 "Fundamentals of the theory of plasticity and creep", each of which is a logically complete, relatively independent, integral part of the discipline, the mastery of which involves conducting module control work and analyzing the results of its implementation.

A separate **third module** (educational component EC39) is a term paper that a student completes in the fourth semester (fifth semester for the FNS). The term paper is an important component of consolidating and deepening the theoretical and practical knowledge and skills acquired by the student in the process of mastering the discipline.

2.2. Module structure and integrated requirements for each module

Module №1 “Fundamentals of the theory of elasticity”

Integrated requirements for module 1: ***to know*** basic hypotheses and methods of classical and applied elasticity theory; stress theory for studying the stressed state; theory of deformation; components of displacement and deformation; dependence between them; continuity solution; generalized Hooke's

law and work of elastic forces; basic equations of elasticity theory and methods of their solution; plane problem of elasticity theory and its solution; bending of thin plates, differential equations and their solution; work of forces and general methods of determining displacements; variational formulation of problems of elasticity theory and approximate methods of their solution; basics of calculation of elastic shells by momentless and moment theory; ***be able*** to use the mathematical apparatus of the theory of elasticity to calculate stresses and strains in engineering structures; justify the results of the calculation and analyze them.

Topic 1: Introduction. The object of study. The main hypotheses. Model environment. Calculation scheme. Object and subject of study of the discipline. Model environment and its application in the resistance of materials. The concept, essence and purpose of the design scheme. Examples of design schemes of load-bearing building structures of buildings and structures. Problems and methods used in the theory of elasticity and plasticity.

Topic 2. Stress theory. General information about the classical stress theory. Limit states and stresses. Differential equations of equilibrium. Stresses on inclined planes. Study of the stress state at a point of the body. Principal stresses. Invariants of the stress state. Stress tensor. Intensity of stresses. The largest tangential stresses.

Topic 3. Deformation theory. Components of displacement and deformation. Dependence between them. Volumetric deflection. Deformation continuity equation. Deformation tensor. Main deformations. Deformation intensity.

Topic 4. Generalized Hooke's law. Expression of strains through stresses and tensions through strains. Hooke's law in tensor form. Work of elastic bodies. Potential energy of deformations.

Topic 5. Solving the problem of elasticity theory. Basic equations of the theory of elasticity and methods of their solution. Solving the problem of the theory of elasticity in displacements. Solving the problem in polynomials. Lamé's equation. Solving the problem of the theory of elasticity in stresses. The Beltrami-Mitchell equation. Solving a plane problem by the method of trigonometric series. Determination of the basic material constants and G. The simplest problems of the theory of elasticity.

Topic 6. A plane problem of elasticity in rectangular coordinates. Planar deformation. Generalized plane stress state. solution of a plane problem in stresses. Stress function. Saint-Venant's principle.

Topic 7: A plane problem of elasticity in polar coordinates. Basic equations. Simple radial stress state. Stress function for a plane problem in polar coordinates. Axisymmetric problems. Solution in displacements. Lamé's problem. Golovin's problem.

Topic 8: Bending thin plates. Basic concepts and hypotheses. Displacement and deformation in a plate.

Topic 9: Variational methods for solving problems on the theory of plate bending. The content of variational methods for solving differential equations. The Ritz-Timoshenko method. The Bubnov-Galerkin method. Vlasov's method. Potential energy in plate bending. examples of problem solving

Topic 10: Fundamentals of thin shells calculation. Calculation of a shell of arbitrary shape by the momentumless theory. Differential equations of equilibrium. Displacements and deformations in a circular cylindrical shell. Calculation of shells of revolution for symmetric loading by the moment theory. The concept of the edge effect. Elements of Vlasov's theory of gentle shells.

Module №2 "Basics of the theory of plasticity and creep"

Integrated requirements for module 2: ***to know*** basic equations of the linear theory of plasticity and methods of their application for solving engineering problems; laws of creep theory under uniaxial loading and under conditions of complex stress; ***be able*** to use the mathematical apparatus of the theories of plasticity and creep to calculate the stress-strain state of structures operating beyond the elastic limit; justify the calculation results and analyze them.

Topic 1: Basic dependencies of the theory of plasticity. Problems of the theory of plasticity. Stress intensity and strain intensity. Criteria of plasticity. Theory of small elastic-plastic deformations

Topic 2. The simplest problems of the theory of plasticity. The basic system of equations of the theory of plasticity and general methods of solution. The method of additional loads. The method of additional deformations. Method of variable elasticity parameters. Variational methods. Application of methods of the theory of plasticity in solving engineering problems.

Topic 3. Basic dependencies of the creep theory. Phenomena of stress creep and relaxation. Basic hypotheses. Mechanical models of deformed body and hereditary hypotheses of creep theory. Strength of materials under creep.

Topic 4: The simplest problems of creep theory. Creep of a prismatic beam in bending. Rod creep in torsion. Creep of thin- and thick-walled cylinders. NDT of a thick-walled spherical shell.

Topic 5. Strength theories for brittle and ductile materials. Problems of strength theories. Brittle and plastic fracture. Classical strength theories for brittle fracture and plastic fracture. Generalized theories of strength.

Topic 6. Calculation of strength and durability under alternating stresses. Fatigue strength of materials. Fatigue curve and endurance limit of a material. Summary cycle amplitudes. Calculations for fatigue strength and durability.

Topic 7. Fundamentals of fracture mechanics. Basic concepts and definitions. Computational model. Stress state in the vicinity of a crack in an elastic region. Griffiths theory of crack propagation in an elastic medium.

Module №3 (educational component EC39) "Course project"

The course project (CP) is carried out in the fourth (fifth for the FNS) semester, in accordance with the methodological recommendations approved in accordance with the established procedure in order to consolidate and deepen the theoretical knowledge and skills acquired by the student in the process of mastering all the educational material of the discipline.

The specific **purpose** of the CP is to determine the NDP at a point of the body, the main stresses acting on the body; construct the main sites in determining the volumetric NDP at a point of the body; calculate the guiding cosines of the normal to the sites; check the feasibility of using the selected function for further solving the plane problem of elasticity theory; determination of external and internal forces acting on the body; construction of diagrams of external and internal forces acting on the body; performing a static check of external and internal forces acting on the body; analytical calculation and construction of diagrams of transverse forces, bending and torque moments arising from bending of the plate. The tasks differ in their variants.

The **content** of the CD provides for the implementation of the calculation part and tasks of theoretical content, which constitute an explanatory note of 25-30 sheets and drawings.

The time required to complete the CD is up to 45 hours of independent work.

2.3. Thematic plan of the academic discipline

№ п/п	Topic	Academic hours							
		Full-time study				Part-time study			
		Total	Lectures	Labs	Self-study	Total	Lectures	Labs	Self-study
1	2	3	4	5	6	7	8	9	10
Module №1 " Fundamentals of the theory of elasticity "									
1.1	Introduction. The object of study. The main hypotheses. Modeling environment. Calculation scheme	**4 semester**				**4 semester**			
		7	2	2	3	-	-	-	-
1.2	Stress theory	**7**	2	2	3	-	-	-	-
1.3	Deformation theory.	**7**	2	2	3	-	-	-	-
1.4	Generalized Hooke's law.	**7**	2	2	3	-	-	-	-
1.5	Solving the problem of elasticity theory	**7**	2	2	3	-	-	-	-
1.6	A plane problem of elasticity in rectangular coordinates	**7**	2	2	3	-	-	-	-
1.7	Planar problem of elasticity in polar coordinates	**7**	2	2	3	-	-	-	-
1.8	Bending thin plates	**7**	2	2	3	-	-	-	-
1.9	Variational methods for solving problems on the theory of plate bending	**7**	2	2	3	**4 semester**			
						-	-	-	-

1	2	3	4	5	6	7	8	9	10
1.10	Fundamentals of thin shells calculation	**4**	2	-	2	-	-	-	-
1.11	Module control work №1	**3**	-	2	1	-	-	-	-
	Total for Module 1	**70**	20	20	30				
Module №2 " Basics of the theory of plasticity and creep "									
2.1	Basic dependencies of the theory of plasticity.	**7**	2	2	3	-	-	-	-
2.2	The simplest problems of the theory of plasticity	**7**	2	2	3	-	-	-	-
2.3	Basic dependencies of the creep theory	**7**	2	2	3	-	-	-	-
2.4	The simplest problems of creep theory	**7**	2	2	3	-	-	-	-
2.5	Strength theories for brittle and ductile materials	**7**	2	2	3	-	-	-	-
2.6	Calculations of strength and durability under alternating stresses	**7**	2	2	3	-	-	-	-
2.7	Fundamentals of fracture mechanics	**4**	2	-	2				
2.8	Module control work №2	**3**	-	2	1				
	Total for Module 2	**50**	14	14	22				
Module №3 " Course project "									
3.1	A plane problem of elasticity theory. Planar and volumetric NDP at a point of a body. Bending of plates.	*45*	-	-	45	-	-	-	-
	Total for Module 3	***45***	**-**	**-**	***45***	-	-	-	-
	Total for Academic Discipline	***165***	***34***	***34***	***97***	-	-	-	-

2.4. List of questions for exam and final test

The list of questions and the tasks to prepare for the exam are developed by the teacher of the department in accordance with the work program and communicated to the students.

3. TRAINING MATERIALS FOR THE DISCIPLINE

3.1. Teaching Methods

When studying the discipline, the following teaching methods are used:

- explanatory-illustrative method;
- method of problem statement;
- reproductive method;
- research method.

The implementation of these methods is carried out during lectures, laboratory work, demonstrations, independent problem solving, work with educational and normative-technical literature.

3.2. Recommended literature

Basic literature

3.2.1. Трач В.М. Опір матеріалів (спеціальний курс) теорія пружності та пластичності: підручник / В.М. Трач, А.В. Подворний. – К: Каравела, 2016.

3.2.2. Можаровський М.С. Теорія пружності, пластичності і повзучості: підручник для вузів / М. С. Можаровський. – К. : Вища школа, 2002. – 308 с.

3.2.3. Божидарник В.В. Елеменит теорії пружності / В.В. Божидарник, Г.Т. Сулим. – Львів: Світ, 1994. – 560 с.

3.2.4. Бородачов М. М. Теорія пружності та пластичності: навчальний посібник / М.М. Бородачов, М. І. Савченко. - К.: НАУ, 2006.- 224 с.

3.2.5. Писаренко Г.С. Опір матеріалів : підручник / 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.

3.2.6. Мартиненко А.О., Подворний А.В. Опір матеріалів (спеціальний курс). Частина І: Навчальний посібник. – Рівне: НУВГ, 2010. – 334 с.

Additional literature

3.2.8. Корнілов Г.Л. Теорія пружності в прикладах та задачах. – К.: ХАІ, 1994. – 196 с.

3.2.9. Опір матеріалів з основами теорії пружності й пластичності [Текст] : У двох частинах, п'яти книгах. Книга І : Загальні основи курсу. Ч.1 : Підручник у трьох книгах / В.Г. Піскунов, В.К. Присяжнюк; За ред. проф. В.Г.Піскунова. – К. : Вища школа, 1994. – 204с.

3.2.10. Бабенко А. Є. Теорія пружності : підручник. Ч. 1 / А. Є. Бабенко, М. І. Бобир, С. Л. Бойко, О. О. Боронко. - К. : Основа, 2009. - 239 с.

3.2.11. Баженов В. А. Будівельна механіка: Електронний підручник / В. А Баженов, О. В. Шишов. – К., 2008. – 436 с.

3.2.12. Чихладзе Е. Д. Опір матеріалів: Навч. посібник / Чихладзе Е.Д. – Х: УкрДАЗТ. 2002. – 362 с.

3.3. Information resources on the Internet

3.3.1. http://www.lib.nau.edu.ua/php/index.php
3.3.2. https://www.springer.com/journal/00419
3.3.3. https://www.elibrary.ru/title_about.asp?id=32550
3.3.4. https://www.elibrary.ru/title_about.asp?id=9008
3.3.5. https://www.youtube.com/channel/UCY1VGmBzf2iFbKWJy3vy4KQ
3.3.6. http://opir.knuba.edu.ua/content/pro-zbirnik-0

4. RATING SYSTEM OF KNOWLEDGE AND SKILLS ASSESSMENT

4.1. Evaluation of certain types of work done by students of the points made in accordance with Tables.4.1.

Table 4.1.

Type of educational work	Max number of points		Type of educational work	Max number of points	
	Full-time form of study	Correspondence form of study		Full-time form of study	Correspondence form of study
4 semester /4,5 semester ЗФН					
Module №1: "Fundamentals of the theory of elasticity"			Module №2 "Fundamentals of the theory of plasticity and creep"		
Type of educational work	points	points	Type of educational work	points	points
Laboratory work 9x4=36, 3x10=30 (ЗФН)	36	30	Laboratory work 6x4=24, 2x5=10	24	0
Performing control (homework) work	-	20			
In order to be admitted to the module test №1, a student must score at least	*25*	–	*To be admitted to the module test №2, a student must score at least*	*15*	–
Performing modular control work №1	10	–	Performing a modular control work №2	10	-
Total for module №1	46	50	**Total for module №2**	34	**10**
Total for modules №1, №2				**80**	**60**
Semester exam				**20**	**40**
Total by discipline					**100**

Module №3	
Type of educational work	Max number of points
	Full-time and part-time education
Implementation of the course project	60
Defense of the course project	40
Completion and defense of a course project	**100**

A Semester Grade is determined (in points and in the National Scale) as a result of performing all kinds of educational work during the semester.

4.2 The completed types of academic work are credited to the student if he received a positive rating for them.

4.3. The sum of the rating grades received by the student for certain types of completed academic work is the current module rating grade, which is entered in the module control record.

4.4. The final semester rating grade is converted to the national scale and ECTS scale.

4.5 The final semester rating grade in points, according to the national scale and the ECTS scale is entered in the test-examination record, study card and student's record book, for example 92/Excellent/A, 87/Good/B, 79/Good/C, 68/Failing/D, 65/Failing/E, etc.

4.6 The final rating grade in the discipline is equal to the final semester rating grade. The specified final rating grade in the discipline is entered in the Diploma Supplement.

(Ф 03.02 – 01)

АРКУШ ПОШИРЕННЯ ДОКУМЕНТА

№ прим.	Куди передано (підрозділ)	Дата видачі	П.І.Б. отримувача	Підпис отримувача	Примітки

(Ф 03.02 – 02)

АРКУШ ОЗНАЙОМЛЕННЯ З ДОКУМЕНТОМ

№ пор.	Прізвище ім'я по-батькові	Підпис ознайомленої особи	Дата ознайом-лення	Примітки

(Ф 03.02 – 04)

АРКУШ РЕЄСТРАЦІЇ РЕВІЗІЇ

№ пор.	Прізвище ім'я по-батькові	Дата ревізії	Підпис	Висновок щодо адекватності

(Ф 03.02 – 03)

АРКУШ ОБЛІКУ ЗМІН

№ зміни	№ листа (сторінки)				Підпис особи, яка внесла зміну	Дата внесення зміни	Дата введення зміни
	Зміненого	Заміненого	Нового	Анульо-ваного			

(Ф 03.02 – 32)

УЗГОДЖЕННЯ ЗМІН

	Підпис	Ініціали, прізвище	Посада	Дата
Розробник				
Узгоджено				
Узгоджено				
Узгоджено				

(F 21.01 – 03)

Syllabus of the academic discipline
«RESISTANCE OF MATERIALS (SPECIAL COURSE) AND BASICS OF THE THEORY OF ELASTICITY AND PLASTICITY»
Educational and professional program:
«Industrial and Civil Engineering»,
Field of study: 19 «Architecture and Construction»
Specialty: 192 «Building and Civil Engineering»

Level of higher education	First (Bachelor)
Discipline status	Academic discipline of the selective component
Course	2
Semester	4
ECTS credits / hours	5,5 / 165
Language of training	Ukrainian, English
What will be studied (subject of study)	The basic methods of the theory of elasticity and plasticity, reliability and fracture mechanics in the spectrum of practical problems studied at the level of a bachelor of civil engineering
Why is it interesting / necessary to study (goal)	The discipline creates the basis for the formation of engineering thought, thinking and intuition and provides the theoretical level of knowledge and practical skills of a specialist in the field of construction of buildings and structures.
Why can you learn (learning outcomes)	Theoretical provisions of the theory of elasticity and plasticity, basic calculation formulas and limits of their applicability, scientific and technical terminology, physical quantities and units of their measurement; methods of calculation for strength, stiffness and stability of structural elements and structures that correspond to the current state of knowledge in the theory of elasticity and plasticity; ability to analyze numerical results of theoretical and experimental studies. PLO2 – Participate in research and development in the field of architecture and construction. PLO5 – Use and develop technical documentation at all stages of the life cycle of construction products. PLO7 – Perform data collection, interpretation and application, including through the search, processing and analysis of information from various sources. PLO11 – Demonstrate an understanding of the design principles of urban areas and infrastructure. PLO12 – Have in-depth cognitive and practical skills/attainments, mastery and innovation at the level necessary to solve complex specialized tasks in the field of construction and civil engineering. PLO17 – Mastering work skills to work effectively independently (course and diploma design) or in a group (laboratory classes, including leadership skills in their implementation), the ability to obtain the desired result in a limited time with an emphasis on professional integrity and the exclusion of plagiarism.

How to use the acquired knowledge and skills (competencies)	IC. The ability to solve complex specialized tasks and practical problems in the field of construction or in the learning process, which involves the application of theories and methods of determining the strength, stability, durability, reliability and safety of buildings and structures; application of information technologies, software complexes, automated design systems. General competencies that the discipline enables you to acquire: GC1 – Ability to think abstractly, analyze and synthesize. GC2 – Knowledge and understanding of the subject area and professional activity. GC3 – Ability to communicate in the state language both orally and in writing. GC5 – Ability to use information and communication technologies. GC6 – Ability to independently acquire knowledge by searching, processing and analyzing information from various sources. GC7 – Interpersonal skills. Professional competencies that the discipline enables you to acquire: PC1 – Ability to use conceptual scientific and practical knowledge of mathematics, chemistry and physics to solve complex practical problems in construction and civil engineering. PC3 – Ability to design building structures, buildings, structures and engineering networks (according to specialization), taking into account engineering and resource-saving measures, legal, social, environmental, technical and economic indicators, scientific and ethical aspects, and modern requirements of regulatory documentation in the field of architecture and construction, environmental protection and labor safety. PC6 – Ability to perform engineering activities in the field of construction, compilation and use of technical documentation. PC7 – Ability to take responsibility for developing and making decisions in the field of architecture and construction in unpredictable work contexts.
Educational logistics	**Contents:** Object and subject of study of the discipline. Model environment and its application in the resistance of materials. Problems and methods used in the theory of elasticity and plasticity. The theory of stresses. The theory of deformation. Generalized Hooke's law. Solving problems of the theory of elasticity and plasticity. Flat problem of the theory of elasticity. Bending of thin plates. Variational methods for solving problems on the theory of plate bending. Fundamentals of calculation of thin shells. Basic dependencies of the theory of plasticity. Problems of the theory of plasticity. Basic dependencies of the theory of creep. The simplest problems of creep theory. Theories of strength for brittle and ductile materials. Calculations of strength and durability under the action of alternating stresses. Fundamentals of fracture mechanics. **Classroom sessions:** lectures, laboratory classes. **Teaching methods:** explanatory and illustrative method, method of problem presentation, reproductive and research methods. **Form of training:** full-part
Prerequisites	"Higher Mathematics", "Theoretical Mechanics (Statics)", "Introduction to Civil Engineering"

Porekvizyty	"Building structures", "Construction organization", "Metal structures", " Foundation Engineering "	
Information support from the repository and fund of NTB NAU	Можаровський М.С. Теорія пружності, пластичності і повзучості: підручник для вузів / М. С. Можаровський. – К. : Вища школа, 2002. – 308 с. Бабенко А. Є. Теорія пружності : підручник. Ч. 1 / А. Є. Бабенко, М. І. Бобир, С. Л. Бойко, О. О. Боронко. - К. : Основа, 2009. - 239 с. Бородачов М. М. Теорія пружності та пластичності: навчальний посібник / М. М. Бородачов, М. І. Савченко. - К.: НАУ, 2006.- 224 с.	
Location and logistics	http://www.lib.nau.edu.ua	
Semester control, examination methods	test tasks, module tests, written exam	
Depertment	Construction Computer Technologies and Airports Reconstruction	
Faculty	Archictecture, civil engineering and design	
Professor		**HORB OLEKSANDR** **Position:** Associate Professor **Scientific degree:** Candidate of Sciences **Academic title:** - **Profile:** http://iap.nau.edu.ua/images/LAP_ACRED/npp2/Gorb.pdf **tel.: 044-406-74-25** **E-mail:** oleksandr.horb@npp.nau.edu.ua **Room:** 5.510
Originality of academic discipline	Original	
Link to discipline	https://er.nau.edu.ua/handle/NAU/24905	