(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
«9» 12 2022

APPROVED
Vice Rector for Academics
_____ Anatolii POLUKHIN
«14» 12 2022

Quality Management System

COURSE TRAINING PROGRAM
on
"Solid Mechanics"

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	3	120/4,0	17	-	34	69	–	-	Graded Test 3th semester

Index: ECB-5 - 192 - 1/22 - 3.3

The Course Training Program on "Solid Mechanics" is developed on the basis of the Educational-Professional Program "Industrial and Civil Engineering", Bachelor Curriculum and Extended Curriculum № CB-5-192-1/21, № 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:

Senior lecturer of the Computer Technologies of Airport Construction and Reconstruction Department _____ Ihor MASHKOV

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 № 12 of October, 25, 2022.

Guarantor of the Educational and Professional Program _____ Nataliia KOSTYRA

Head of the Department _____ Oleksandr LAPENKO

Vice Rector on International Collaboration and Education

_____ Iryna ZARUBINSKA

«12» 12 2022

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CONTENTS

INTRODUCTION

The Course Training Program of the academic discipline "Solid Mechanics" 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 Solid Deformed Body" occupies a leading **role** in the process of professional training for the qualified performance of professional duties of specialists, is the theoretical and practical basis of the body of knowledge and skills that form the profile of a specialist in the field of construction and civil engineering. Studying the course of this discipline is aimed at gaining knowledge of the basics of designing buildings and structures for various purposes.

The goal of teaching the discipline is to teach students modern methods of structural calculations, skills in determining the forces of interaction between the structure and the environment, between different elements of the structure and between the individual parts of each element, the application of acquired skills in the learning process and future professional activities in the field of construction and civil engineering.

The objectives of the discipline are:

- study and mastering of basic concepts, theoretical provisions and methods of calculation for strength of engineering structures;
- study of the state of solids, changes in the size and shape of real bodies under the application of external forces, changes in temperature, installation of structures;
- mastering the methods of calculation of solid deformed bodies for different types of loading.

1.2. Educational outcomes of the academic discipline

As a result of studying this discipline the student should know

- principles and methods of calculation for strength and stiffness of structural elements that are part of buildings and structures;

- methods of calculation of solids of different nature, deformed under various influences;

- main directions of development of mechanics of solid deformed bodies and automated systems used in engineering practice for optimal design and calculation of structures of construction objects;

- ways of using the results of solving problems to improve the operational and technical characteristics of existing and prospective objects.

The program learning outcomes are:

- have in-depth cognitive and practical skills, mastery and innovation at the level necessary to solve specialized problems in the field of civil and structural engineering (according to specialization) (PLO 12);

- mastering the working skills to work effectively independently or in a group (laboratory work, 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 (PLO 17).

1.3. Competencies obtained through the academic discipline

According to the content of the discipline, the applicant for higher education must be able to:

- to show the ability to establish and develop the laws of deformation and fracture of materials, to identify the relationship between the structure of materials, the nature of external influences and the processes of deformation and fracture;

- to show the ability to formulate the problem and apply methods of solving boundary value problems for the calculation of solids of different nature, deformed under various influences;

- as a result of the calculation to assess the potential performance of systems of building structures and their elements that carry the main load, to determine the causes and make informed decisions to eliminate the consequences and prevent dangerous destruction;

- use basic software tools for implementing methods on a PC.

General competencies that the discipline provides an opportunity to acquire: knowledge and understanding of the subject area and professional activities (CC2), the ability to independently acquire knowledge by searching, processing and analyzing information from various oral, written and electronic sources (GC6), the ability to develop and manage projects, ensuring the safe operation of employees and the quality of work performed (PC11).

Professional competencies that the discipline provides an opportunity to acquire: the ability to design building structures, buildings and structures, taking into account engineering, technical and resource-saving measures, legal, social,

environmental, technical and economic indicators, scientific and ethical aspects, and modern requirements of regulatory documents in the field of architecture and construction, environmental protection and occupational safety (PC3), the ability to organize and manage the professional development of individuals and groups in the field of architecture and construction (PC9); knowledge of the theoretical foundations of mechanics of solid deformed body, to perform on their basis calculations of the stress-strain state of the main structural elements of buildings and structures in the design of industrial and civil engineering (PC 12).

1.4. Interdisciplinary links

The discipline "Solid Mechanics " has an interdisciplinary character and combines courses of professional training disciplines. This discipline is based on the knowledge of such disciplines as "Introduction to Civil Engineering", "Higher Mathematics", "Theoretical Mechanics (Statics)", in parallel complements the study of such disciplines as "Structural Mechanics" and "Resistance of Materials" and is the basis for the study of further disciplines, namely: "Building structures", "Metal structures", " Bases and foundations".

2. PROGRAM OF THE ACADEMIC DISCIPLINE

2.1. Content of the academic discipline

The educational material of the discipline is structured according to the modular principle and consists of **one educational module** № 1: "Theoretical foundations of mechanics of solid deformed bodies", which is a logically complete, relatively independent, integral part of the discipline, the mastering of which involves conducting modular control work and analysis of the results of its implementation.

2.2. Module structure and integrated requirements for each module

Module №1 “Theoretical foundations of mechanics of solid deformed bodies”

Integrated requirements for module 1: ***to know*** basic concepts, definitions and problems of mechanics of a solid deformed body; stress tensor and its components; stress state at a point of a body; deformations around a point of a body; generalized Hooke's law; complete system of equations for an isotropic body; stresses and forces in thin plates; complete system of shell equations and methods of its solution; plane stress and plane deformed states; methods of solving boundary value problems; ***be able*** to use the basic concepts and theoretical

principles of the stress-strain state of the body, the theory of plates and shells; to know the principles and methods of calculating boundary value problems of the theory of elasticity in stress and displacement, finite difference and finite element methods.

Topic 1: Basic concepts and definitions. Bodies and loads applied to them. Non-force influences. Material model. Internal forces of interaction. Stress tensor and its components. Forces. Epures of forces. Relationship between forces and intensity of distributed loads. Problem of mechanics of a solid defo rmed body.

Topic 2. Stress state at a point of the body. Equation of equilibrium at a point of the body. Stresses on inclined platforms. Extremum of normal stresses. Orthogonality of the main sites. Invariants of stress tensor. Extremum of tangential stresses. Octahedral stresses.

Topic 3. Deformations around a point of the body. Conditions of compatibility of displacements and deformations at a point of a body. Conditions of compatibility of deformations at a point of a body. Deformations around a point of a body.

Topic 4. Relationship between stresses and strains for Hooke's body. Linear elasticity. Hooke's law of shear for an isotropic body. Generalized Hooke's law. Potential energy of deformation. Generalized Hooke's law for an anisotropic body. Complete system of equations for an isotropic body. Solution of the boundary value problem of the theory of elasticity in stress. Solution of the problem of the theory of elasticity in displacements. The only solution of the problem of the theory of elasticity.

Topic 5. Statics of plates. Theory of thin elastic shells. Stresses in thin plates. Equation of plate bending. Boundary conditions. Forces in plates. Bending of rectangular slab. Classification of plates. Geometry of shells and basic assumptions about the nature of their deformation. Equations of equilibrium. Geometric equations. Physical equations. Complete system of shell equations and methods of its solution. Equations of state of momentless shells. Equations of state of shells of revolution. Calculation of a spherical dome. Equation of state of a cylindrical shell. The edge effect. Gentle shells.

Topic 6. Flat problem of the theory of elasticity. Plane stress and plane deformed states. Complete system of equations of the plane problem. Solution of the plane problem in stresses. Solution in polynomials. Bending of a cantilever of rectangular profile. Bending of an articulated beam.

Topic 7: Methods for solving boundary value problems. The method of finite differences. The method of finite elements. Triangular finite element of plane problem of elasticity theory. Conditions of convergence. Rectangular finite element of plane problem of elasticity theory. Calculation of thin rigid plates. Spatial problem of the theory of elasticity.

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 "Elements of metal structures and their welding"									
1.1	Basic concepts and definitions. Bodies and loads applied to them. Non-force influences. Material model. Internal forces of interaction.	**3 semester**				**3 semester**			
		7	2	2	3	**6**	-	-	6
1.2	Stress tensor and its components. Forces. Epures of forces. Problem of mechanics of solid deformed body.	**6**	-	2	4	**7**	-	-	7
1.3	Stress state at a point on the body. Equation of equilibrium at a point on the body.	**7**	2	2	3	**8**	2	-	6
1.4	Stresses on inclined sites. Extremum of normal stresses. Orthogonality of the main sites. Invariants of stress tensor. Extremum of tangential stresses. Octahedral stresses.	**6**	-	2	4	**5**	-	-	5
1.5	Deformations around a point of the body.	**5**	-	2	3	**6**	-	-	6
1.6	Stress-strain state around a point of the body.	**7**	2	2	3	**7**	-	-	7
1.7	Relation between stresses and strains for Hooke's body. Hooke's law of shear for an isotropic body. Generalized Hooke's law.	**7**	2	2	3	**6**	2	-	4
1.8	Potential energy of deformation. Generalized Hooke's law for an anisotropic body. Complete system of equations for an isotropic body.	**6**	-	2	4	**4**	-	-	4
1.9	Solution of the boundary value problem of the theory of elasticity in stress. Solution of the problem of the theory of elasticity in displacements. The only solution of the problem of the theory of elasticity.					**4 semester**			
		9	2	2	5	**9**	-	2	7
1.10	Statics of plates. Stresses in thin plates.	**6**	2	2	2	**3**	-	-	3
1.11	Bending equation of the plate. Boundary conditions. Forces in plates. Bending of a rectangular plate.	**5**	-	2	3	**4**	-	-	4
1.12	Theory of thin elastic shells. Complete system of shell equations and methods of its solution. Equations of state of momentless shells. Equations of state of shells of revolution. Calculation of a spherical dome.	**7**	-	2	5	**8**	-	-	8
1.13	Equation of state of a cylindrical shell. Edge effect. Gentle shells.	**6**	-	2	4	**5**	-	-	5
1.14	Flat problem of the theory of elasticity. Plane	**8**	2	2	4	**9**	-	2	7

1	2	3	4	5	6	7	8	9	10
	stress and plane deformed states. Complete system of equations of the plane problem. Solution of the plane problem in stresses. Solution in polynomials. Bending of a cantilever of rectangular profile. Bending of an articulated supported beam.								
1.15	Methods for solving boundary value problems.	**6**	-	2	4	**6**	-	-	6
1.16	Solving problems by the finite difference method.	**8**	-	2	6	**6**	-	-	6
1.17	Solving problems by the finite element method.	**12**	2	2	8	**10**	-	2	8
1.18	Control (home) work.	-	-	-	-	**8**	-	-	8
1.19	Final semester control work	-	-	-	-	**3**	-	2	1
1.20	Module Test №1	***2***	*1*	-	1	-	-	-	-
Total for Module 1		***120***	***17***	***34***	***69***	***120***	***4***	***8***	***108***
Total for Academic Discipline		***120***	***17***	***34***	***69***	***120***	***4***	***8***	***108***

2.4. Task for control (home) work

Control (homework) in the discipline is performed in the seventh semester, in accordance with the approved methodological recommendations, in order to consolidate and deepen the theoretical knowledge and skills of the student in the study of the discipline. The task for the practical part of the control (home) task is carried out by the student individually in accordance with the guidelines.

The time required to complete homework is 8 hours of independent work.

2.5. 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. Можаровський М.С. Теорія пружності, пластичності і повзучості: Підручник.- К.: Вища школа, 2002. – 308 с.

3.2.2. Дубенець В.Г., Савченко О.В. Механіка деформованого твердого тіла: Курс лекцій.- Чернігів.: ЧНТУ, 2016. – 139 с.

3.2.3. Крутій Ю.С. Механіка деформівного твердого тіла: Навч. посібник / Ю.С. Крутій, Д.В. Лазарєва, М.Г. Сур'янінов. – Одеса: ОДАБА, 2017. – 260 с.

3.2.4. Божидарник В.В. Елеменит теорії пружності / В.В. Божидарник, Г.Т. Сулим. – Львів: Світ, 1994. – 580 с.

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

3.2.6. 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.

3.2.7. Бородачов М. М. Теорія пружності та пластичності: Навч. посібник / М.М. Бородачов, М. І. Савченко. - К.: НАУ, 2006. – 224 с.

Additional literature

3.2.8. Лисицин Б.М. Чисельні методи рішення задач будівництва: Конспект лекцій. – К.: КМУЦА, 1999. – 52 с.

3.2.9. Чихладзе Е.Д. Основи лінійної теорії пружності, пластичності та повзучості: Навч. посібник / Е.Д. Чихладзе, М.А. Веревічева, Є.І. Галагуря та ін. – Харків: УкрДАЗТ, 2010. – 149 с.

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.

3.3. Internet information resources

3.3.1. http://iap.nau.edu.ua/index.php/kafedry/komp-yuternikh-tekhnologij-budivnitstva

3.3.2. Website of the Scientific and Technical Library of the National Aviation University https://www.lib.nau.edu.ua/main

3.3.3. http://er.nau.edu.ua/handle/NAU/24905

3.3.4. Methodical publications of the department (in electronic form).

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.

Kind of Academic Activities	Maximum Grade	
	Full-time study, points	Part-time study, points
3 semester/3,4 semester		
Модуль № 1 «Theoretical foundations of mechanics of solid deformed bodies»		
Laboratory works 17x4p=68; 3x10p=30	68	30
Performing control (homework)	–	40
Final semester control work	–	30
For admission to the modular control work work No. 1, the student must score at least	*26*	–
Performing modular control work №1	32	–
Total for module №1	**100**	**100**
Total for academic discipline	**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
«AIRPORT BUILDINGS AND STRUCTURES»
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	3, 4
ECTS credits / hours	4,0 / 120
Language of training	English
What will be studied (subject of study)	Basic concepts, theoretical provisions and methods of calculation for the strength of engineering structures, the state of solids, changes in the size and shape of real bodies when applying external forces, changes in temperature conditions, installation of structures, methods of calculation of solid deformed bodies for various types of loading
Why is it interesting / necessary to study (goal)	The purpose of teaching the discipline is to teach students modern methods of structural calculations, skills in determining the forces of interaction between the structure and the environment, between different elements of the structure and between the individual parts of each element, the application of acquired skills in the learning process and future professional activities in the field of construction and civil engineering
Why can you learn (learning outcomes)	The applicant for higher education acquires knowledge of the ability to formulate a problem and apply methods for solving boundary value problems for the calculation of solids of different nature, differently deformed under various influences; the establishment and development of the laws of deformation and fracture of materials, the identification of relationships between the structure of materials, the nature of external influences and the processes of deformation and fracture; the main directions of development of solid deformed body mechanics and automated systems used in engineering practice at optimal Students also acquire in-depth cognitive and practical skills, mastery and innovation at the level necessary to solve specialized problems in the field of civil and structural engineering

How to use the acquired knowledge and skills (competencies)	General competencies that the discipline enables to acquire: knowledge and understanding of the subject area and professional activities, the ability to independently acquire knowledge by searching, processing and analyzing information from various oral, written and electronic sources, the ability to develop and manage projects, ensuring the safety of employees and the quality of work performed. Professional competencies that the discipline provides an opportunity to acquire: the ability to design building structures, buildings and structures, taking into account engineering, technical and resource-saving measures, legal, social, environmental, technical and economic indicators, scientific and ethical aspects, and modern requirements of regulatory documents in the field of architecture and construction, environmental protection and occupational safety, the ability to organize and manage the professional development of individuals and groups in the field of architecture and construction; knowledge of theoretical and practical skills in the field of architecture and construction.

Educational logistics	**Contents:** Theoretical foundations of mechanics of solid deformed body. Basic concepts and definitions. Bodies and loads applied to them. Non-force influences. Material model. Internal forces of interaction. Stress tensor and its components. Forces. Epures of forces. Problem of mechanics of a solid defo rmed body. Stress state at a point of the body. Equation of equilibrium at a point of the body. Stresses on inclined platforms. Extremum of normal stresses. Or-togonality of the main sites. Invariants of stress tensor.Extremum of tangential stresses. Octahedral stresses. Deformations around the point of the body. Stress-strain state around a point of a body. Relationship between stresses and strains for Hooke's body. Hooke's law of shear for an isotropic body. Generalized Hooke's law. Potential energy of deformation. Generalized Hooke's law for an anisotropic body. Complete system of equations for an isotropic body. Solution of the boundary value problem of the theory of elasticity in stress. Solution of the problem of the theory of elasticity in displacements. The only solution of the problem of the theory of elasticity. Statics of plates. Stresses in thin plates. Equation of bending of the plate. Boundary conditions. Forces in plates. Bending of rectangular plate. Theory of thin elastic shells. Complete system of shell equations and methods of its solution. Equations of state of momentless shells. Equations of state of shells of revolution. Calculation of a spherical dome. Equation of state of a cylindrical shell. The edge effect. Gentle shells. Flat problem of the theory of elasticity. Planar stress and plane deformed states. Complete system of equations of the plane problem. Solution of the plane problem in stresses. Solution in polynomials. Bending of a cantilever of rectangular profile. Bending of an articulated beam. Methods for solving boundary value problems. Solution of problems by the method of finite differences. Solution of problems by the method of finite elements. Spatial problem of the theory of elasticity. **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	"Introduction to Construction Engineering", "Higher Mathematics", "Theoretical Mechanics (Statics)", " Strength of Materials", "Construction Mechanics"
Porekvizyty	" Construction mechanics (special course)", "Building structures", "Metal structures", " Bases and foundations"

Information support from the repository and fund of NTB NAU	Можаровський М.С. Теорія пружності, пластичності і повзучості: Підручник.- К.: Вища школа, 2002. – 308 с. Дубенець В.Г., Савченко О.В. Механіка деформованого твердого тіла: Курс лекцій.- Чернігів.: ЧНТУ, 2016. – 139 с. Гольдштейн Ю.Б. Основы механики твердого деформируемого тела: Учеб.пособие/ Ю.Б. Гольдштейн.- Петрозаводск.: ПетрГУ, 2005. – 872 с. Александров В.М. Аналитические методы в контактных задачах теории упругости / В. М. Александров, М.И. Чебаков. – М.: Физматлит, 2004. – 304 с. Бундаев В.В. Руководство к решению задач по механике твердого деформируемого тела матричными методами: учебное пособие. Улан-Удэ: Изд-во ВСГТУ, 2005. - 223 с. Ватульян А.О. Обратные задачи в механике деформируемого твердого тела / А. О. Ватульян. – М.: Физматлит, 2007. – 224 с. Власов А.В. Основы теории напряженного и деформированного состояний: Учебн. пособие / А.В. Власов. — М.: МГТУ им. Н.Э. Баумана, 2006. — 83 с. Зайцев Ю. В. Механика разрушения для строителей. – М.: Стройиздат,1996. – 162 с. Лисицин Б.М. Чисельні методи рішення задач будівництва: Конспект лекцій. – К.: КМУЦА, 1999. – 52 с. Розин Л. А. Метод конечных элементов в применении к упругим системам / Л. А. Розин. – М.: Стройиздат, 1987. – 364 с. Перельмутер А. В. Расчетные модели сооружений и возможности их анализа / А. В. Перельмутер, В. И. Сливкер. – К.: Сталь, 2002. – 600 с. Александров А.В., Потапов В.Д. Основы теории упругости и пластичности: Учеб. для строит. спец. вузов.- М.: Высш. школа, 1990. – 400с.	
Location and logistics	http://www.lib.nau.edu.ua	
Semester control, examination methods	tests, module test	
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	Author's course	
Link to discipline	https://er.nau.edu.ua/handle/NAU/24905	