GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of Materials, PG_00064120		
Field of study	Wytrzymałość materiałów		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Applied Mechanics and Biomechanics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Oleksii Nosko	
	Teachers	dr hab. inż. Oleksii Nosko mgr inż. Katarzyna Pytka dr inż. Alicja Stanisławska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	15.0	0.0	0.0	75

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 46661 Wytrzymałość materiałów, W/C, IMM, sem. 03, zima 25/26 (PG_00064120)
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=46661

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Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	75	10.0	65.0	150

Subject objectives

The course provides students with knowledge of Strength of Materials. The basic terms, assumptions, principles and methods of the subject are treated. The main emphasis is on the development of skills to efficiently schematise, solve and analyse typical problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W03] has knowledge in rigid body mechanics, biomechanics, modelling of mechanical system, vibration and strength analysis of mechanical structures or knowledge in the use of computer programs for analyzing and simulating mechanical systems, and the design process	Student can apply knowledge related to the strength of materials to analyse mechanical strength of materials and products	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym [SW1] Ocena wiedzy faktograficznej
[K6_U04] is able to utilize empirical, analytical, simulation, and computer-based methods to formulate and solve engineering tasks in the field of medical and mechanical engineering	Student can apply knowledge related to the strength of materials to solve problems referring to the mechanical and medical engineering	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU1] Ocena realizacji zadania

Subject contents

Course content – lecture

Introduction and terminology. Normal force. Shear force. Twisting moment. Bending moment. Normal stress. Shear stress. Pascal. Normal strain. Shear strain. Stress-strain diagram. Yield stress. Ultimate stress. Elasticity. Plasticity. Condition of stress. Working stress. Geometry of cross sections. Moments of inertia. Parallel-axis theorem. Principal axes. Principal moments of inertia. Tension and compression. Axial force. Hooke's law. Elastic modulus. Poisson's ratio. Torsion. Shaft. Angle of twist. Shear modulus. Bending stresses. Beam. Pure bending. Transverse force. Neutral axis. Section modulus. Bending deflections. Elastic curve. Deflection of beam. Equation of the elastic curve. Combined loading. Skew bending. Eccentric axial loading. Frame. Strength theories. Stress tensor. Stress vector. Principal stresses. Mohr's circles. Strength theory. Equivalent stress.

Course content – exercises

Static moments and centroid. Moments of inertia. Principal moments of inertia. Stresses in an axially loaded bar. Displacements in an axially loaded bar. Stresses in a pin-joint truss. Bar systems with a rigid element. Torsion of a circular shaft. Bending moments in a beam. Stresses in a beam. Deflections and slopes in a beam. Combined loading of a cross section. Bending stresses in a plane frame. Equivalent stress. Stresses in a frame.

Course content – laboratory

Static tensile and compression tests. Metal specimen tension test: determination of the elasticity modulus, conventional elasticity limit and conventional plasticity limit. Investigation of metal hardness. Metal specimen torsion test and determination of the shape elasticity modulus. Beam deflection investigation. Metal impact strength test. Impact test of a metal tension.

Prerequisites and co-requisites

Knowledge of Higher Mathematics, specifically: algebra, trigonometry, geometry, differential and integral calculus, vector and matrix calculus. Knowledge of Mechanics, specifically: static equilibrium conditions, the principle of conservation of mechanical energy.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practice	56.0%	25.0%
Labs	56.0%	25.0%
Exam	56.0%	50.0%

Recommended reading

Basic literature

1. A. Jakubowicz, Z. Orłoś, Wytrzymałość materiałów, wyd. 5, Wydawnictwa Naukowo-Techniczne, Warszawa, 1978.

2. Z. Dyląg, A. Jakubowicz, Z. Orłoś, Wytrzymałość materiałów, tom 1, wyd. 2, Wydawnictwa Naukowo-Techniczne, Warszawa, 1999.

3. M. Banasiak, K. Grossman, M. Trombski, Zbiór zadań z wytrzymałości materiałów, wyd. 2, Wydawnictwo Naukowe PWN, Warszawa, 1998.

Supplementary literature

1. J.M. Gere, B.J. Goodno, Mechanics of materials: Brief edition, Cengage Learning, 2012.

2. A. Pytel, J. Kiusalaas, Mechanics of materials, 2nd ed., Cengage Learning, 2012.

3. W.A. Nash, M.C. Potter, Schaums outline of strength of materials, 5th ed., McGraw-Hill, 2011.

eResources addresses

Example issues/ example questions/ tasks being completed

1. Find the size a at which the bar carries the loads with safety factor n. L=2 m, σ_yp=100 MPa, q=2 kN/m, n=2.

2. Find the maximum intensity m of the twisting moment at which the shaft can carry the loads without yielding. L=0.7 m, a=8 mm, τ_yp=60 MPa.

3. Find the minimum size a at which the beam can carry the bending load without yielding. L=2 m, t=1.5 mm, σ_yp=80 MPa, w_0=90 N/m.

4. Find the deflection and slope angle φ (in degrees) of the beam at the force application point. L=1 m, EI=5*10^5 Nm^2, F=300 N.

5. Find the maximum load P which can be carried by the cross section without yielding. a=60 mm, t=5 mm, σ_yp=400 MPa, ψ=45°.

Practical activites within the subject

Not applicable

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