GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Mechanics of materials, PG_00064820						
Field of study	Mechanical Engineering						
Date of commencement of studies	February 2026		Academic year of realisation of subject	2025/2026			
Education level	second-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	1		Language of instruction	Polish			
Semester of study	1		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Beata Zima				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
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	30		5.0	15.0		50
Subject objectives	1. Providing knowledge in the field of analysis and solving problems of mechanics and strength of one-dimensional systems (bars, beams, frames). 2. Preparing the student to solve problems involving complex cases of material strength. 3.Developing the ability to solve statically and geometrically indeterminate frame systems.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U01] utilizes information obtained from the literature and other sources in the field of Mechanics and Mechanical Engineering and presents and analyses the results of solutions to technical problems in this field	The student, equipped with knowledge of mathematical analysis methods and numerical experiments, is able to apply it to solve engineering tasks within the specified scope using the Finite Element Method (FEM) as a modern and effective computational approach implemented in commercial software systems (e.g., Femap, Ansys).	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	The student is able to assess the applicability of advanced methods and tools for solving complex engineering problems in the field of mechanics of materials. They effectively utilize appropriate techniques, such as strength analysis of structural elements as a basis for using the Finite Element Method (FEM), to develop practical technical solutions.	[SU2] Assessment of ability to analyse information
[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes	The student has the ability to apply computational methods and techniques for strength and material analysis to examine and describe the functioning of the specified systems, processes, and device properties.	[SW1] Assessment of factual knowledge

Subject contents

1. Introduction, classification of structure elements. Specification and definitions of elements of bar and planar structures. Presentation: Internal forces in 2D and 3D bar systems.
2. Stress analysis. Definition of the stress vector with its components in the normal and tangential directions in the case of a three-dimensional Cartesian space; The concept of a stress tensor with its special cases. Thermal stresses.
3. State of deformation, constitutive relation. Description of the deformation state of three-, two- and one-dimensional deformations in terms of small displacements and deformations. Hooke's law and a general description of constitutive relations.
4. The principle of virtual work and its applications. The principle applies to the statics of bar systems in the variants of the theoretical basis of the Force Method (FM) and Displacement method (DM).
5. The Force Method and the Displacement Method. Definition of unknowns, coefficients for unknowns, canonical equation. Basics of the classical approach to the Displacement Method (DM) applied to beam and frame systems.
6. Tensile - axial compression. State of stress and deformation.
7. Bending. Moment applied about principal axis and moment arbitrarily applied.
8. Shear in bending. Center of shear (twisting).
9. Torsion of prismatic and thin-walled rods.
10. Failure theories - yield criteria.
11. Thin-walled pressure vessels.

Prerequisites and co-requisites

The student knows and is able to apply the laws of technical mechanics.
He knows and is able to solve simple cases of material strength.
He knows the basics of higher mathematics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture test	50.0%	40.0%
Solving problems	50.0%	60.0%

Recommended reading

Basic literature	1. Gross D. i inni: Engineering Mechanics 2. Mechanics of Materials. Springer, 2011. Engineering Mechanics 2: Mechanics of Materials | SpringerLink 2. Hibbeler R.C.: Mechanics of Materials. Prentice Hall, 8th Edition, 2011.
Supplementary literature	1. Hibbeler R. C.: Engineering Mechanics, Statics. 12ve Edition, 2013.
eResources addresses	

Example issues/ example questions/ tasks being completed

1. Draw the stress vector and its components in the general case of the vector location, name the components of the stress vector. What planes (sections) do we call the principal?
2. Give the rules for dimensioning the cross-section (determining the dimensions of the cross-section) taking into account the strength condition and the stiffness condition in the case of tension / compression.
3. Draw graphs of the maximum tangential and normal stresses in a cantilever loaded with a concentrated force P at its end.

Work placement

Not applicable