GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of Materials, PG_00060456		
Field of study	Mechanical and Naval Engineering		
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	Part-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	7.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Mechanical Vehicles and Military Technology -> 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. Szymon Grymek	
	Teachers	dr inż. Marek Skowronek mgr inż. Anna Grzeczka	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	27.0	27.0	9.0	0.0	0.0	63
	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	63	11.0	101.0	175

Subject objectives	The aim of the course is to familiarize students with the basic issues related to the strength of materials. The lectures concern, in turn: compressive / tensile, torsional, bending and shear strength of a straight bar; strength analysis for statically indeterminate bar systems; stress states; state of stress and deformations; methods of determining stresses and deformations for statically indeterminate bar systems; stresses and deformations of systems of bars by the energy methods; bar buckling, basics of the finite element method FEM.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] possesses knowledge on mechanics, including the processes of modelling mechanical systems, statics, kinematics and dynamics of rigid objects and basic knowledge on vibrations	The student has the ability to analyze basic issues related to the strength of materials in the field of theory and solving simple tasks and practical problems. This applies to the topics mentioned in the purpose of the subject. Many of these topics relate to general mechanical engineering problems.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_U10] is able to formulate the principles of selecting a material for a construction, ensuring the correct operation of a device	The student has the ability to solve basic problems related to the strength of materials, including the performance of simple engineering tasks. A student is able to prove a choice of materials depending on the stycture considered. A student is able to evaluate a possibility of satysfying the design and operational criteria for the data structure.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W03] possesses and is able to practically apply the knowledge on the construction, properties and testing methods of construction materials	The student has the ability to analyze the basics of material strength including the typical construction materials like the steel and aluminium, and in the case of composite materials made of fibre glass or carbon glass. The student has the ability to model issues related to the strength of materials in the field of rigid bodies, biomechanics, mechanical systems, vibrations and basic mechanical structures.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_W05] possesses an organized and theoretically grounded knowledge within the range of strength analysis of mechanical constructions including stress and relaxation conditions, energetic methods, strength hypotheses	The student has the ability to analyze the basics of material strength, the compressive / tensile strength of a straight bar, strength analysis for statically indeterminate bar systems, torsional strength of bars, beam strength - bending, deformation of a bent beam, bar shear (shear bar), stress states, stress state and deformations, methods of determining stresses (shear forces, bending moments) and deformations for statically indeterminate bar systems, determination of elastic energy, stresses and deformations of bars and bar systems - energy methods, determination of elastic energy, stresses and deformations of beams and frames using the Maxwell method -Mohra, bar buckling, basics of the finite element method FEM. The student has the ability to model issues related to the strength of materials in the field of rigid bodies, biomechanics, mechanical systems, vibrations and basic mechanical structures.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_U06] is able to use mathematical and physical models for analysing the processes and phenomena occurring in mechanical devices within the range of material strength, thermodynamics and fluid mechanics	The student has the ability to analyze basic issues related to the strength of materials, connected with structures and machines, in the field of theory and solving simple tasks and practical problems. This applies to the topics mentioned in the purpose of the subject. Many of these topics are related to the mechanical engineering together with solving the typical strength of materials, termodynamics and fluid mechanics problems.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

Subject contents	The lectures concern, in turn: the basis of material strength, the compressive / tensile strength of a straight bar, strength analysis for statically indeterminate bar systems, torsional strength of bars, beam strength - bending, deformation of a bent beam, bar shear (shear bar), stress states, state of stress and deformations, methods of determining stresses (shear forces, bending moments) and deformations for statically indeterminate bar systems, determination of elastic energy, stresses and deformations of bars and bar systems - energy methods, determination of elastic energy, stresses and deformations of beams and frames using the Maxwell method -Mohra, bar buckling, basics of the finite element method FEM.	
Prerequisites and co-requisites	The student should have basic information in the field of applied physics and mathematics, mathematical analysis, numerical methods, solid state mechanics, including kinetics and dynamics, technical drawing and the basics of programming.	
Assessment methods and criteria	Subject passing criteria: Passing the half term and final exam	Passing threshold: 56.0% / Percentage of the final grade: 100.0%
Recommended reading	Basic literature	**Bibligraphy:** 1. Bąk R., Burczyński T.: Wytrzymałość materiałów z elementami ujęcia komputerowego. WNT, Warszawa 2001. 2. Dyląg Z., Jakubowicz A., Orłoś Z.: Wytrzymałość materiałów. WNT, Warszawa, t. I 1996, t. II 1997. 3. Misiak J.: Mechanika techniczna. Statyka i wytrzymałość materiałów. WNT, Warszawa 1996. 4. Kaliński K. J.: Nadzorowanie procesów dynamicznych w układach mechanicznych. Gdańsk: Wydaw. PG 2012. 5. Gallagher R. H.: Finite element analysisfundamentals. New Jersey: Prentice Hall 1975. 6. Niezgodziński M.E., Niezgodziński T.: Wzory, wykresy i tablice wytrzymałościowe. Warszawa: WNT 1996. 7. Walczyk Z.: Wytrzymałość materiałów. Wyd. PG, Gdańsk t. I 2000, t. II 2001. 8. Żmuda J.: Projektowanie konstrukcji stalowych. Wydawnictwo Naukowe PWN, 2016.
	Supplementary literature	**Additional bibliography:** 1. Ship Construction by D. J. Eyres, Butterworth-Heinemann, 2001. 2. Elements of Modern Ship Construction by David J. House, 2010. 3. Ship Construction 7th Edition, by George J Bruce, Butterworth-Heinemann, May 2012. 4. Ship Construction and Welding by **Mandal**, Nisith Ranjan, Springer Series on Naval Architecture, Marine Engineering, Shipbuilding and Shipping.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Example 1. It refers to assembly stresses, which most often arise as a result of striving for structural correction, i.e. forced displacement of a structural element. Solution to the problem: To mount a member of length l between two vertical faces, its length must be increased by D. A tensile force N will appear in the cross-section of the member, which causes mounting stress: = E (D/l). Example 2. Typical design problem for bending beams: A beam with a length of 2 l and stiffness EI, hinged at the ends, is loaded with an evenly distributed load q acting along the length l. Formulate the equation for the deflection angles (x) and the deflection axis (x) and determine the deflection angle and deflection at point B: B and the deflection axis B.	
Work placement	Not applicable	

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