GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of Materials , PG_00055379		
Field of study	Mechanical Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	10.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Wiktoria Wojnicz	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	45.0	60.0	15.0	0.0	0.0	120
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	120	10.0	120.0	250

Subject objectives

The aim of the course is to familiarize students with methods applied in the area of strength of materials

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Student can formulate strength of material model of the tested construction and analyse its behavior considering loading and boundary conditions.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_U01] is able to acquire information from specialized literary sources, databases and other resources, essential for solving engineering tasks; is able to compile the obtained information pieces and to interpret them, additionally is able to form conclusions and present justified opinion	Student can solne advanced problems related to the strength of materials of construction by using knowledge acquainted	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
[K6_W05] possesses an organized and theoretically grounded knowledge within the range of strength analysis of basic mechanical constructions including stress and relaxation conditions, energetic methods, strength hypotheses	Student can state and solve simple tasks related to strength of materials of the given construction/ system	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation

Subject contents	**LECTURES/TUTORIALS** Area moments of inertia. Tension and compression of bars. Statically indeterminable problems. Thermal and assembly deformations. Torsion of bars. Bending of beams. Determination of inner forces and stresses in bars (dimensioning). Plane state of stresses. Mohrs circle. Principal stresses and maximum shear stresses. Theorem of Castigliano. Theorem of Menabrei-Castigliano. Method of Maxwell-Mohr. Buckling investigation. Calculation of statically indeterminable systems with a use of the force method. Unsymmetrical beam bending. Eccentric loading. Bending of thin-walled bars. Bending of curved bars. Calculation of thin-walled shells of revolution. Determination of stresses of the pressure vessels. Calculation of thick-walled cylindrical shells. The Lame problem. Calculation of thick-walled pipes. Calculation of bending of axisymmetric plates. Fatigue strength problems. Fracture mechanics. Finite element method fundamentals: bar element and 2D planar element. **LABS** Static tensile and compression tests. Metal tension test: determination of elasticity modulus, conventional elasticity limit and conventional plasticity limit. Investigation of metal hardness. Metal torsion test and determination of shape elasticity modulus. Beam deflection investigation. Metal impact strength test. Impact test of a metal tension.
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 threshold	Percentage of the final grade
Lectures passing	56.0%	40.0%
Tutorials passing	56.0%	30.0%
Labs passing	56.0%	30.0%

Recommended reading

Basic literature	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	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	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Assembly stresses - arise as a result of correcting dimensional differences of the connected elements of the structure. Example. To install a bar of length l between two vertical walls, increase its length by D. A tensile force N appears in the cross-section of the bar, which causes assembly stresses. 2. Example. A beam with a length of 2l and stiffness EI, pinned at its ends, is loaded with a uniformly distributed load q acting on length l. Formulate the equation of deflection angles and deflection axis and determine the deflection angle and deflection at point B.
Work placement	Not applicable