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 2022	Academic year of realisation of subject	2023/2024
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. Bogdan Rozmarynowski	
	Teachers	dr hab. inż. Bogdan Rozmarynowski mgr inż. Katarzyna Pytka dr hab. inż. Wojciech Macek dr inż. Maciej Kahsin mgr inż. Emil Roch mgr inż. Paweł Bielski	

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 engineering methods applied in the area of strength of materials

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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
[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

Subject contents

LECTURES/TUTORIALS

Problems and assumptions of the strength of materials. Stress and strain state. Second moments of area. Tension and compression of bars. Statically indeterminable problems. Thermal and assembly deformations. Torsion of bars. Bending of beams. Determination of internal forces and stresses in bars (dimensioning). Plane state of stresses, plane state of strains, constitutive relationship. Mohr's circle. Principal stresses and maximum shear stresses. Strength issues under combined loads. Elastic energy of bar systems. Energy theorems: Castigliano, on virtual work, formulas of Maxwell-Mohr. Buckling investigation. Calculation of statically indeterminable systems with a use of the force and displacement methods. Bending of curved bars. Calculation of thin-walled shells of revolution. Determination of stresses of the pressure vessels. Calculation of thick- and thin-walled pipes. The Lame problem. Calculation of bending of axisymmetric plates. Fatigue strength problems. Fracture mechanics. Fundamentals of the finite element method: bar elements and 2D (plane) elements.

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	60.0%	30.0%
Tutorials passing	60.0%	50.0%
Labs passing	60.0%	20.0%

Recommended reading	Basic literature	1. Dyląg Z., Jakubowicz A., Orłoś Z.: *Wytrzymałość Materiałów t. I i II.* WNT Warszawa 2003. 2. Bijak-Żochowski M. i inni: Mechanika materiałów i konstrukcji. Oficyna Wydawnicza PW 2013. 3. Bąk R., Burczyński T.: Wytrzymałość materiałów z elementami ujęcia komputerowego. WNT, Warszawa 2013 4. Bielewicz E.: *Wytrzymałość materiałów*. Politechnika Gdańska, Gdańsk, 2013. 5. Zielnica J.: Wytrzymałość materiałów. Wydawnictow Politechniki Poznańskiej 1998. 6. Banasiak M., Grossman K., Trombski M.: Zbiór zadań z wytrzymałości materiałów. Warszawa 2013. 7. Niezgodziński M., Niezgodziński T.: Zadania z wytrzymałości materiałów. WNT Warszawa, 2016. 8. Walczyk Z.: Wytrzymałość materiałów. Wyd. PG, Gdańsk t. I 2000, t. II 2001. 9. Kacprzyk Z., Rakowski G.: MES w mechanice konstrukcji. Warszawa 2005. 10. Żmuda J.: Projektowanie konstrukcji stalowych. Wydawnictwo Naukowe PWN, 2016.
	Supplementary literature	1.Jastrzębski P., Mutermilch J., Orłowski W.: *Wytrzymałość materiałów*. Arkady, Warszawa 1974. 2. Niezgodziński M.E., Niezgodziński T.: Wzory, wykresy i tablice wytrzymałościowe, Warszawa WNT 1996. 3. Hibbeler R.G.: Mechanics of materials, Prentice-Hall Int. Inc., 10th Ed., 2017. 4. Królak M. i inni: Zbiór zadań z wytrzymałości materiałów. Politechnika Łódzka, 2008 cz.1, 2010 cz.2. 5. Ship Construction 7th Edition, by George J Bruce, Butterworth-Heinemann, May 2012. 6. Zienkiewicz O. C.: Metoda elementów skończonych, Arkady 1972.
	eResources addresses	Adresy na platformie eNauczanie: Wytrzymałość materiałów (PG_00055379), [W], Inż., WIMiO, zimowy, 2023/2024 - Moodle ID: 33162 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33162
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. Draw a diagram of longitudinal forces and a diagram of stresses in a member whose length l = 3a is subject to an error e, where e is much smaller than a and the member was pressed into a rigid structure with a span of 3a. 2. Example. A beam with a length of 2 l and stiffness EI=const, hinged at the ends, is loaded with an equally distributed perpendicular load q, acting along the length l. Formulate the equation of the line of the deflected axis and determine the deflection angles on the supports and the deflection at the middle of the beam span.	
Work placement	Not applicable	

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