GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of materials, PG_00055882		
Field of study	Power Engineering, Power Engineering, Power 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	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Marine Structural Engineering -> Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Bogdan Rozmarynowski	
	Teachers	dr inż. Maciej Kahsin mgr inż. Adrian Wolski dr hab. inż. Bogdan Rozmarynowski dr inż. Grzegorz Gajowiec	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	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	60	5.0	60.0	125

Subject objectives	The aim of the course is to familiarize students with the basic issues related to the strength of materials: the basis of material strength, the compressive / tensile strength of a straight bar, analysis for statically determinate and indeterminate bar systems, torsional strength of bars, beam strength - bending and deformation, bar shear, stress states and deformations, methods of determining stresses and deformations for statically indeterminate bar systems, determination of elastic energy, stresses and deformations by energy methods; yielding criteria; buckling of bars, basics of the finite element method.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U11] Can design and properly dimension basic foundations in hydrotechnical construction facilities; can evaluate and list the loads acting on constructions, knows the codes of modern geotechnical investigations and technologies, knows the principles of foundations and safe design of foundations of typical buildings	The student has the ability to analyze basic issues related to the applied mechanics and strength of materials in the field of theory and solving simple tasks and practical problems. This includes the topics mentioned in the subject purpose and later. The student has the ability to assess the usefulness of the presented content both from the point of view of designing technical objects and their operation in the broadly understood technology, energy and environmental protection.	[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_W16] has an elementary knowledge about energy and environmental construction including building materials, their strength, construction mechanics and building physics, moisture migration in buildings, heat transfer through building partitions, has a basic knowledge of marine and inland hydrotechnical structures; has knowledge of the hydraulic and hydrological conditions of designing facilities and building structures, photogrammetry, remote sensing, hydrography, and spatial analysis.	The student has the ability to analyze the basics of energy construction and strength of materials, 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_K01] is aware of the need for training and self-improvement in the profession of energy and the possibility of further education; can think and act in a creative and entrepreneurial manner; can define priorities for the implementation of an individual or group task	The student has the ability to self educate and 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 mechanical and medical engineering.	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work [SK2] Assessment of progress of work [SK1] Assessment of group work skills
	[K6_W04] has structured knowledge of mechanics, including the issues of material strength and general principles of shaping structures, necessary to conduct basic strength analyzes and design simple mechanical or construction systems for power industry or environmental engineering; knows the basics of machine construction and the most commonly used construction and operating materials	The student has the ability to solve basic problems related to the strength of materials, including the performance of simple engineering tasks, taking into account the existing regulations and standards concering the structures including the energy structures.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
Subject contents	Lecture content: basic topics of material strength, stress and strain states, constitutive equations; the compressive / tensile strength of a straight bar, statically determinate and indeterminate stress states, thermal stresses and effects of assembly errors; torsional strength of bars, beam strength - bending, deformation of a bent beam; shear stresses of bars, state of stress caused by combined loadings; statics of statically indeterminate bar systems, determination of elastic energy bar systems - energy methods; deformations of beams and frames using the Maxwell-Mohr method; buckling of bars, 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.		

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<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>laboratory excercises</td><td>50.0%</td><td>20.0%</td></tr>
<tr><td>exam</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>tutorials</td><td>50.0%</td><td>30.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Bibliography:

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.</td></tr>
<tr><td>Supplementary literature</td><td>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. . Zienkiewicz O. C.: Metoda elementów skończonych, Arkady 1972.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Wytrzymałość materiałów En (PG_00055882), W, I stopień, sem3, 2024-2025 - Moodle ID: 40958
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40958
Wytrzymałość materiałów (PG_00055882), En, Ć(BR), inż., sem. zimowy, 2024-25 - Moodle ID: 41365
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=41365</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">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. Determine this force.

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 one of the supports.</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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