GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of Materials, PG_00044001		
Field of study	Civil Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Magdalena Rucka	
	Teachers	dr inż. Łukasz Pachocki dr inż. Tomasz Ferenc dr inż. Aleksandra Kuryłowicz-Cudowska dr inż. Dawid Bruski prof. dr hab. inż. Magdalena Rucka prof. dr hab. inż. Jacek Chróścielewski dr inż. Erwin Wojtczak prof. dr hab. inż. Wojciech Witkowski mgr inż. Tomasz Wiczenbach mgr inż. Błażej Meronk	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	0.0	0.0	0.0	90
	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	90	7.0	53.0	150

Subject objectives	Determination of stresses, strains and deflections in bar elements Identification of the problems of Strength of Materials Analysis of complex stress states Stability analysis of structural elements Assessment of limit load-carrying capacity of cross-sections of bar elements.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] can analyze simple rod constructions in scope of: calculations of constructions statically determined and undetermined; determining of modal frequencies; calculations of linear stability and bearing capacity in critical and boundary states	Student transforms stresses and strains in two-dimensional cases. Student determines stresses on the basis of the cross-sectional forces in bar elements. Student performs the element dimensioning with respect to the Ultimate and Serviceability Limit States. Student recognizes the cases of elastic and plastic (limit state) design. Student provides stability analysis of structures and their elements.	[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
[K6_W04] has knowledge of general mechanics, strength of materials and general rules of construction	The student exhibits a background on mechanics of bar structures and strength of materials. The student identifies the problems of Strength of Materials.	[SW1] Assessment of factual knowledge

Subject contents

Assumptions and the scope of Strength of Materials (SM). Stress and strain - definitions. Plane stress and plane strain. Three-dimensional stress and strain state. Hookes law (constitutive relations). Boundary problem of linear elasticity theory. Classification of problems of Strength of Materials. Axial tension (compression), statically indeterminate cases, stress concentration. Results of laboratory tests of materials 1 tension/compression. Geometrical parameters of cross-sections. Uniaxial and biaxial bending. Bending with tension/compression, core of the cross-section, eccentric compression with the tension zone excluded. Free torsion of rods. Circular and rectangular cross-sections. Open thin-walled cross-sections, closed thin-walled cross-sections (Bredt formulae). Joints of structural elements. Shear stresses at bending. Open thin-walled cross-sections, shear centre (bending centre). Compound and multiple beams. Composite beams tension/ compression, bending. Deflection line of a beam. Eulers equation, integration methods. Moment-area method (Mohrs method). Redundant cases. Potential energy of elastic strain. Clapeyrons theorem. Unit energy of elastic strain (shear, compression, bending, torsion). Castiglianos theorems calculating deflections (beams, frames, trusses), graphical integration. Stability of beams. Elastic and inelastic buckling. Design of axially compressed beams. Beams on elastic foundation, Winklers hypothesis. Strength criteria, eqiuvalent stresses. Elements of plasticity theory. Material models. Limit load-carrying capacity of a cross-section (axial tension/compression, bending, tension/compression with bending). Plasticity zones of a beam. Cables. Stresses perpendicular to the beams axis under bending. Curvilinear beams, temsion/compression, bending. Elements of rheology, time-dependent material models. Results of laboratory tests of materials 2 creep, relaxation and fatigue tests. Restrained torsion of open-shaped thin-walled cross-sections.

Prerequisites and co-requisites

Structural (Engineering) Mechanics
Mathematics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	60.0%	100.0%

Recommended reading

Basic literature	1. Bielewicz E.: Strength of Materials (in Polish). Politechnika Gdańska Gdańsk 1992 and other editions 2. Szymczak Cz., Skowronek M., Witkowski W., Kujawa M.: Strength of Materials - problems (in Polish). Politechnika Gdańska, Gdańsk 2002. 3. Chróścielewski J.: Strrength of Materials - lecture presentations (in Polish). www.okno.pg.gda.pl
Supplementary literature	1. Jastrzębski P., Mutermilch J., Orłowski W.: Wytrzymałość materiałów. Arkady, Warszawa 1974. 2. Orłowski W., Słowiański L.: Wytrzymałość materiałów. Przykłady obliczeń. Arkady, Warszawa 1974.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Determine axial forces in a truss / truss-frame system, determine stresses and deflections.

Draw the normal stress diagram at a cross-section of a beam at bending, determine the allowable load due to elastic load-carrying capacity.

Determine buckling load of a bar, given boundary conditions and a cross-section, perform the elastic buckling check.

Work placement

Not applicable