



## Subject card

Subject name and code	, PG_00059023						
Field of study	Environmental 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		
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			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Structural Mechanics Department -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Karol Winkelmann					
	Teachers	dr inż. Karol Winkelmann dr inż. Marcin Krajewski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	5.0	5.0	0.0	0.0	20
	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	20	3.0		52.0	75	
Subject objectives	Presentation of the basics of Strength of Materials. Stresses and strains definitions. Relations between stresses, internal forces and deformations. Identification of axial tension/compression. Technical dimensioning analysis due to ULS and SLS. Determination of geometric characteristics of cross sections. Identification of bending (one and two-dimensional), eccentric compression, technical shear, bending-connected shear, and simple torsion. Analysis of complex stress states. H-M-H hypothesis (reduced stress). Stability and deflection analysis of elements.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W08] has elementary knowledge of construction: including building materials, their strength, construction mechanics and building physics, moisture migration in buildings, heat transfer through building partitions	The student transforms stresses and strains in flat and spatial states. The student identifies respective load cases, determines the stresses on the basis of internal forces in beam systems. The student determines geometric characteristics of cross sections. The student is able to perform the technical dimensioning of beam systems due to limit states of load capacity and serviceability. The student analyzes the stability and deflection of structures.	[SW1] Assessment of factual knowledge
	[K6_W02] has knowledge of physics, including mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics and solid state physics, including knowledge necessary to: 1) understand the basic physical phenomena related to material durability, fluid mechanics and hydraulics, building physics, geodetic measurements ; 2) understanding the principles of operation of basic electrical devices and systems; 3) solving project tasks of the sanitary industry;	The student transforms stresses and strains in flat and spatial states. The student identifies respective load cases, determines the stresses on the basis of internal forces in beam systems. The student determines geometric characteristics of cross sections. The student is able to perform the technical dimensioning of beam systems due to limit states of load capacity and serviceability. The student analyzes the stability and deflection of structures.	[SW1] Assessment of factual knowledge
Subject contents	Fundamentals of Strength of Materials. Stresses and strains definitions. Relations between stresses and internal forces. Plane Stress State and Plane Strain State. Relations between stresses and deformations. Axial tension/compression. Geometric characteristics of flat figures. Static moments and center of gravity. Moments of inertia (central, main). Simple (one-dimensional) bending. Two-dimensional bending. Eccentric compression. Core of a cross section. Technical shear. Bending shear. Free torsion. Complex stress states. Huber-Mises-Hencky (HMH) hypothesis. Stability (elastic buckling). Deflection. Ultimate load capacity.		
Prerequisites and co-requisites	Theoretical Mechanics Mathematics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam	60.0%	60.0%
	test	0.0%	20.0%
	laboratory	0.0%	20.0%
Recommended reading	Basic literature	Górski J., Przewłócki J., Skowronek M., Winkelmann K., Mechanika i Wytrzymałość Materiałów. Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2015. Bielewicz E.: Wytrzymałość materiałów. Wydawnictwo Politechniki Gdańskiej, Gdańsk, 1992. Szymczak C., Skowronek M., Witkowski W., Kujawa M.: Wytrzymałość materiałów. Zadania. Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2002.	
	Supplementary literature	Jastrzębski P., Mutermilch J., Orłowski W.: Wytrzymałość materiałów. Tom I, II. Arkady, 1985. Niezgodziński M., Niezgodziński T.: Wytrzymałość materiałów. PWN Warszawa, 1984.	
	eResources addresses	Adresy na platformie eNauczenie: Wytrzymałość Materiałów 2023/2024 - Inżynieria Sanitarna, st. niestacjonarne - Moodle ID: 32294 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=32294">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=32294</a>	
Example issues/ example questions/ tasks being completed	Calculate the numerical values of normal stresses. Check whether the load carrying capacity of the components has been exceeded. Calculate the axial elongation / shortening of the elements of the system. Determine the minimum required constant wall thickness of the thin-walled box section of the beam due to bending only. Calculate the equation of the neutral axis of the cross section. Based on the obtained equation, create a drawing of the normal stress projection onto the cross-sectional plane. Calculate the numerical value of shear stresses. Make an overview diagram of shear stresses. Check whether the eccentric compressive force is applied to the cross-sectional core. Check whether the maximum compressive force will lead to stability loss. Calculate the system deflection. Check if the allowable deflection is exceeded.		
Work placement	Not applicable		