



Subject card

Subject name and code	Strength of Materials, PG_00044376						
Field of study	Civil Engineering						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2021/2022		
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	Part-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		8.0		
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		dr inż. Stanisław Burzyński				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	10.0	10.0	10.0	0.0	60
	E-learning hours included: 0.0						
	Adresy na platformie eNauczanie: Wytrzymałość Materiałów Niestacjonarne 2021/22 zima - Moodle ID: 14592 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=14592						
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		7.0		133.0	200
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_W04] has knowledge of general mechanics, strength of materials and general rules of construction		The student recognizes the degree of static determinability of the structure. Student is able to determine the state of stress in bars. The student is able to rationally select the shape of the cross-section of the rod.				
	[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 plane states. Student identifies strength cases. The student determines stresses on the basis of internal forces in bar systems. The student measures the cross-sections of bars according to the limit states: bearing capacity and serviceability. The student recognizes the dimensioning in the elastic state and in the plastic / boundary state. The student analyzes the stability of the structure and its elements.				

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, equiualent 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.		
Prerequisites and co-requisites	Mechanics of Structures - determination of diagrams of internal forces in beam, frame and truss systems Mathematics - basics of matrix calculus Physics - the basics of the theory of elasticity		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project	60.0%	20.0%
	laboratory	60.0%	10.0%
	test	60.0%	20.0%
	exam	60.0%	50.0%
Recommended reading	Basic literature	1. Bielewicz E. WYTRZYMAŁOŚĆ MATERIAŁÓW 2. Jastrzębski, Mutermilch, Orłowski WYTRZYMAŁOŚĆ MATERIAŁÓW 3. Jakubowicz, Orłoś WYTRZYMAŁOŚĆ MATERIAŁÓW 4. Orłowski, Słowiński WYTRZYMWŁOŚĆ MATERIAŁÓW Przykłady obliczeń. 5. Zakrzewski, Zawadzki WYTRZYMAŁOŚĆ MATERIAŁÓW 6. Rzyśko J. STATYKA I WYTRZYMAŁOŚĆ MATERIAŁÓW 7. Piechnik S. WYTRZYM. MAT. DLA WYDZ.BUDOWLAN. 8. Więckowski J. WYTRZYMAŁOŚĆ MATERIAŁÓW Przykłady i teoria. 9. Piskorski, Trębacki ZBIÓR ZADAŃ Z WYTRZ. MATER. 10. Łączkowski R. WYTRZYMAŁOŚĆ MATERIAŁÓW 11. Praca zbiorowa prac. KMBiM, red. Czesław Szymczak ZBIÓR ZADAŃ Z WYTRZYMAŁOŚCI MATERIAŁÓW	
	Supplementary literature	no items	
	eResources addresses	Wytrzymałość Materiałów Niestacjonarne 2021/22 zima - Moodle ID: 14592 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=14592	
Example issues/ example questions/ tasks being completed	Calculation tasks in the field of: - determination of principal stresses, Hooke's law - load capacity of bolted connections - stability of the axially compressed rod Theoretical tasks in the field of: - the concepts of stress and strain - geometrical characteristics of flat figures - linear and nonlinear analyzes, orders of structure theory		
Work placement	Not applicable		