GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Strength of Materials, PG_00044376		
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	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	Department of Mechanics of Materials and Structures -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tomasz Ferenc	
	Teachers	dr inż. Łukasz Pachocki dr inż. Błażej Meronk dr inż. Tomasz Ferenc	

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

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 imit 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 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.	
[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.	

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.
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
exam	60.0%	50.0%
test	60.0%	20.0%
laboratory	60.0%	10.0%
project	60.0%	20.0%

Recommended reading	Basic literature	1. Bielewicz E. WYTRZYMAŁOŚĆ MATERIAŁÓW 2. Jastrzębski, Mutermilch, Orłowski WYTRZYMAŁOŚĆ MATERIAŁÓW 3. Jakubowicz, Orłoś WYTRZYMAŁOŚĆ MATERIAŁÓW 4. Orłowski, Słowiański WYTRZYMWŁOŚĆ MATERIAŁÓW Przykłady obliczeń. 5. Zakrzewski, Zawadzki WYTRZYMAŁOŚĆ MATERIAŁÓW 6. Rżysko 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	Adresy na platformie eNauczanie:
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	

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