



Subject card

Subject name and code	Theory of elasticity and plasticity, PG_00042222						
Field of study	Civil Engineering						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2024/2025		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		English		
Semester of study	1		ECTS credits		5.0		
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. Marek Skowronek				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	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	Characterization of the kinematics, balance laws and material behavior of 3D continua.						
	Determination of stresses, strains and deflections in elastic bodies, including plane strain & stress.						
	Distinction between elastic and inelastic material behavior.						
	Determination of safety reserves due to plasticity in 2D and 3D stress states						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	The student understands problems of solid mechanics in the subject range, and is able to connect solid mechanics to the practical engineering problems in structural design	[SW1] Assessment of factual knowledge
	[K7_U06] is able to choose proper tools (measuring, analytical or numerical) to solve engineering problems, to acquire, filtrate, proces and analyse data	The student selects the appropriate solution method according to the problem	[SU1] Assessment of task fulfilment
	[K7_W04] has knowledge on advanced strength of materials, modeling and optimisation of materials and constructions; has knowledge of fundamentals of Finite Element Method and general nonlinear analysis of engineering constructions and systems	The student understands problems of solid mechanics in the subject range	[SW1] Assessment of factual knowledge
	[K7_U03] can perform classic statical and dynamical analysis of rod structures stability (trusses, frames and ties), both statically determined and undetermined as well as surface structures (plates, membranes and shells)	The student formulates and solves problems of solid mechanics in the subject range, and identifies practical applications in the structural engineering	[SU1] Assessment of task fulfilment
Subject contents	Preliminaries. Assumptions and scope of theory of elasticity. Tensor calculus, Cartesian tensors, tensor algebra, differential operators, integral theorems. Plane stress and plane strain. Airy function in plane stress, plane stress solutions in Cartesian and polar coordinates. Kinematics of continuum, deformation tensors and strain tensors, compatibility conditions. Stress state, Cauchy stress tensor. Balance principles in the theory of elasticity, groups of equations in the theory of elasticity. Constitutive laws, linearly elastic material, generalized Hooke's law, Lamé and engineering constants, hyperelastic materials. Strong formulation of the boundary problem, remarks on weak formulation. Theory of thin elastic plates, kinematic assumptions, stresses and strains, equilibrium of a plate, boundary conditions, rectangular and circular plates examples, plate strips. Elements of theory of plasticity.		
Prerequisites and co-requisites	Structural Mechanics Strength of Materials		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	tests	60.0%	100.0%
Recommended reading	Basic literature	1. Holzapfel G.: Nonlinear Solid Mechanics. A continuum approach for engineers. John Wiley & Sons 2000. 2. Bielewicz E.: Strength of Materials. Politechnika Gdańska, Gdańsk 1992. 3. Fung Y.C.: Podstawy mechaniki ciała stałego. PWN Warszawa, 1969. 4. Girkmann K.: Dźwigiary powierzchniowe. Arkady, Warszawa 1957 (transl. R. Dąbrowski). 5. Kączkowski Z.: Płyty obliczenia statyczne. Arkady, Warszawa 1980. 6. Kmiecik M., Wismur M., Bielewicz E.: Analiza nieliniowa tarcz i płyt. Wyd. PG, Gdańsk 1995. 7. Kreja I.: Continuum Mechanics. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk.	
	Supplementary literature	no items	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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