GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Theory of elasticity and plasticity, PG_00042222		
Field of study	Civil Engineering		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2022/2023
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. Roger Sauer	
	Teachers	dr inż. Roger Sauer	

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
Hookes law, Lame 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.: Dźwigary powierzchniowe. Arkady, Warszawa 1957 (transl. R. Dąbrowski). 5. Kączkowski Z.: Płyty obliczenia statyczne. Arkady, Warszawa 1980. 6. Kmiecik M., Wizmur 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: Theory of Elasticity and Plasticity 2023 - Moodle ID: 30283 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30283

Example issues/ example questions/ tasks being completed

Work placement

Not applicable