

SDAŃSK UNIVERSITY 的 OF TECHNOLOGY

Subject card

Subject name and code	Mechanics of materials, PG_00057378							
Field of study	Mechanical Engineering, Space and Satellite Technologies							
Date of commencement of studies	February 2024		Academic year of realisation of subject		2023/2024			
Education level	second-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	Full-time studies		Mode of delivery			at the university		
Year of study	1		Language of instruction			English		
Semester of study	1		ECTS credits		4.0			
Learning profile	general academic profile		Assessment form		exam			
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Beata Zima					
	Teachers		mgr inż. Paweł Bielski dr hab. inż. Bogdan Rozmarynowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0		0.0	60
	E-learning hours inclu	uded: 0.0	•					
Learning activity and number of study hours	Learning activity	Participation in classes include plan	n didactic ed in study	c Participation in idy consultation hours		Self-study		SUM
	Number of study hours	60		10.0		30.0		100
Subject objectives	 Providing knowledge in the field of analysis and solving problems of mechanics and strength of one- dimensional systems (bars, beams, frames) and selected two-dimensional systems (plates). Preparing the student to solve problems involving complex cases of material strength. Developing the ability to assess the stability of structural elements (forms of stability loss, critical forces). Consolidation of skills of numerical solutions using FEM (finite element method). 							

Learning outcomes	Course outcome	Subject outcome	Method of verification	
	[K7_W01] possesses a profound mathematical knowledge useful in the analysis and description of the operation of complex mechanical systems, technological processes and operating properties of machines and devices; is familiar with the main development trends	The student has the ability to use computational methods as well as strength and material analysis techniques to analyze and describe the operation of the mentioned systems, processes and device properties.	[SW1] Assessment of factual knowledge	
	[K7_W02] possesses a wide and profound knowledge on continuum mechanics and materials strength within the range of modelling and simulating multi-function mechanical systems	The student is able to define the types of planar and spatial bar and surface systems and determine the functions of internal forces (freely supported beams, continuous beams, statically determinate and indeterminate frames, trusses, grids, plates). The student knows how to recognize deformation states (axial and eccentric tension / compression, bending, torsion) and can perform calculations in terms of the state of deformation and stress.	[SW1] Assessment of factual knowledge	
	[K7_U06] when solving engineering problems on design, technology and operation of machines is able to assess and classify typical methods and tools, define systemic and ex-technical aspects using modern calculating methods and design tools or modifying the current ones	The student equipped with knowledge in the field of mathematical methods of analysis and numerical experiments can apply it to solve engineering tasks of the mentioned scope using the Finite Element Method tool as a modern and effective computational method implemented in commercial computer systems (e.g. Femap, Ansys, ABAQUS, etc).	[SU3] Assessment of ability to use knowledge gained from the subject	

Subject contents	INTRODUCTION • Definition of MoM (Mechanics of Materials) • Basic structural concepts in MoM • Static indeterminacy • 3D structural members STRESS and STRAIN • Stress and strain concepts, 3D Hooks law • Stresses and strains in 1D/2D states • Relationships between elastic constants MECHANICAL PROPERTIES OF MATERIALS • Tension and compression tests • Stress strain diagrams • Elastic vs. plastic behaviour • Failure of materials due to creep and fatigue DEFORMATION STATES • Tension/compression • Bending • Torsion • Transverse shear • Combined deformations ENERGY METHODS • External work and strain energy • Elastic strain energy for various types of loading				
	YIELD CRITERIA				
	 Yield criterion - basics Tresca and von Mises yield crite Effective stress 	Yield criterion - basics Tresca and von Mises yield criteria Effective stress			
	FINITE ELEMENT METHOD APPROACH TO MoM				
	Bar systemsSurface systems				
	FUNDAMENTALS OF NONLINEA	R MECHANICS			
	 Material (Lagrange) and spatial (Euler) descriptions Numerical procedures in non-linear mechanics 				
Prerequisites and co-requisites	The student knows and is able to ap He knows and is able to solve simple He knows the basics of higher mathe	ply the laws of technical mechanics. e cases of material strength. ematics.			
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade		
and criteria	EXAM TEST	60.0%	40.0%		
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Recommended reading	Basic literature	 Hibbeler R.G.: Mechanics of materials, Prentice-Hall Int. Inc., 101 Ed., 2017, ISBN 10: 0-13-431965-6. Gere J.M., Goodno B., J.: Mechanics of materials. Brief Ed. Cengage Learning, 2011. Sadd M.H. <i>Elasticity theory, applications and numerics</i>. Elsevier, Oxford 2005 Marti P. Theory of structures, Fundamentals, Framed structures, Plates and Shells. Wilhelm Ernst & Sohn, Berlin, 2013. Zienkiewicz O.C., Taylor R.L.: The Finite Element Method for So and Structural Mechanics. 6th edition, Elsevier Butterworth- Heinemann, 2005. 			
	Supplementary literature	 Case J.: Strength of Materials and Structures. 4th edition, John Wiley 1999 (Knovel, GUT eLibrary) K.J. Bathe: Finite Element Procedures. Prentice Hall 1996. O.C. Zienkiewicz, R.L. Taylor: The Finite Element Method. Vol. 1 The Basis. 5th Edition BH 2000. 			
	eResources addresses	Adresy na platformie eNauczanie: Mechanics of materials (PG_00057378), W/Ć, BM, II stop., sem1,3, lato, 2023/24 - Moodle ID: 37594 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37594			

Example issues/	What differs plane state of stresses of the plane state of strains?
example questions/	What determines elongation of the axially tensioned bar?
tasks being completed	Describe and review yield criteria.of Tresca and von Mises.
Work placement	Not applicable