

## 。 GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

Subject name and code	Mechanics of materials, PG_00064828							
Field of study	Mechanical 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		
						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		2.0			
Learning profile	general academic profile		Assessment form		assessment			
Conducting unit	Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology							
Name and surname	Subject supervisor		dr hab. inż. Beata Zima					
of lecturer (lecturers)	Teachers	dr hab. inż. Bogdan Rozmarynowski						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	t	Seminar	SUM
	Number of study hours	15.0	15.0	0.0	0.0		0.0	30
	E-learning hours inclu	ided: 0.0						
Learning activity and number of study hours	ty Learning activity Participation in classes include plan		n didactic Participation in ed in study consultation hours		Self-study SUM			
	Number of study hours	30		5.0		15.0		50
Subject objectives	<ol> <li>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).</li> <li>Preparing the student to solve problems involving complex cases of material strength.</li> <li>Developing the ability to assess the stability of structural elements (forms of stability loss, critical forces).</li> <li>Consolidation of skills of numerical solutions using FEM (finite element method).</li> </ol>							

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	The student is able to assess the applicability of advanced methods and tools for solving complex engineering problems in the field of mechanics of materials. They effectively utilize appropriate techniques, such as strength analysis, stability assessment of structural elements, and the Finite Element Method (FEM), to develop practical technical solutions.	[SU2] Assessment of ability to analyse information
	[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes	The student has the ability to apply computational methods and techniques for strength and material analysis to examine and describe the functioning of the specified systems, processes, and device properties.	[SW1] Assessment of factual knowledge
	[K7_U01] utilizes information obtained from the literature and other sources in the field of Mechanics and Mechanical Engineering and presents and analyses the results of solutions to technical problems in this field	The student, equipped with knowledge of mathematical analysis methods and numerical experiments, is able to apply it to solve engineering tasks within the specified scope using the Finite Element Method (FEM) as a modern and effective computational approach implemented in commercial software systems (e.g., Femap, Ansys).	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information

Subject contents	INTRODUCTION   Definition of MoM (Mechanics of Materials) Basic structural concepts in MoM Static indeterminacy JD structural members				
	STRESS and STRAIN				
	<ul> <li>Stress and strain concepts, 3D Hooks law</li> <li>Stresses and strains in 1D/2D states</li> <li>Relationships between elastic constants</li> </ul>				
	MECHANICAL PROPERTIES OF MATERIALS				
	<ul> <li>Tension and compression tests</li> <li>Stress strain diagrams</li> <li>Elastic vs. plastic behaviour</li> <li>Failure of materials due to creep and fatigue</li> </ul> <b>DEFORMATION STATES</b>				
	<ul> <li>Tension/compression</li> <li>Bending</li> <li>Torsion</li> <li>Transverse shear</li> <li>Combined deformations</li> </ul>				
	ENERGY METHODS				
	<ul> <li>External work and strain energy</li> <li>Elastic strain energy for various types of loading</li> <li>Principle of virtual work</li> <li>Castiglianos theorem</li> </ul>				
	<ul> <li>YIELD CRITERIA</li> <li>Yield criterion - basics</li> <li>Tresca and von Mises yield criteria</li> <li>Effective stress</li> <li>FINITE ELEMENT METHOD APPROACH TO MoM</li> <li>Bar systems</li> <li>Surface systems</li> <li>FUNDAMENTALS OF NONLINEAR MECHANICS</li> <li>Material (Lagrange) and spatial (Euler) descriptions</li> <li>Numerical procedures in non-linear mechanics</li> </ul>				
Prerequisites and co-requisites	The student knows and is able to apply the laws of technical mechanics. He knows and is able to solve simple cases of material strength. He knows the basics of higher mathematics				
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade		
and criteria	TUTORIAL TEST	60.0%	60.0%		
Recommended reading Basic literature		<ol> <li>Hibbeler R.G.: Mechanics of materials, Prentice-Hall Int. Inc., 10<sup>th</sup> Ed., 2017, ISBN 10: 0-13-431965-6.</li> <li>Gere J.M., Goodno B., J.: Mechanics of materials. Brief Ed. Cengage Learning, 2011.</li> <li>Sadd M.H. <i>Elasticity theory, applications and numerics.</i> Elsevier, Oxford 2005</li> <li>Marti P. Theory of structures, Fundamentals, Framed structures, Plates and Shells. Wilhelm Ernst &amp; Sohn, Berlin, 2013.</li> <li>Zienkiewicz O.C., Taylor R.L.: The Finite Element Method for Solid and Structural Mechanics. 6th edition, Elsevier Butterworth-Heinemann, 2005.</li> </ol>			
	Supplementary literature	<ol> <li>Case J.: Strength of Materials and Structures. 4th edition, John Wiley 1999 (Knovel, GUT eLibrary)</li> <li>K.J. Bathe: Finite Element Procedures. Prentice Hall 1996.</li> <li>O.C. Zienkiewicz, R.L. Taylor: The Finite Element Method. Vol. 1 The Basis. 5th Edition BH 2000.</li> </ol>			
	eResources addresses	Resources addresses     Adresy na platformie eNauczanie:			
Example issues/ example questions/ tasks being completed	What differs plane state of stresses of What determines elongation of the a Describe and review yield criteria.of	of the plane state of strains? xially tensioned bar? Tresca and von Mises.			

Work placement	Not applicable

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