



## Subject card

Subject name and code	Mechanics of materials and biomaterials, PG_00057486						
Field of study	Mechanical and Medical 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 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			Polish		
Semester of study	1	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Zakład Mechaniki Stosowanej i Biomechaniki -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Wiktoria Wojnicz					
	Teachers	dr inż. Alicja Stanisławska dr hab. inż. Wiktoria Wojnicz					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45	10.0		45.0		100
Subject objectives	Acquiring knowledge and skills of solving advanced problems of mechanics of materials and biomaterials						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_K02] He/she understands outer aspects of influence of mechanical engineer and manager, their social consequences and impact on the environment, needs to follow the rules of ethics and respect for the diversities of views and cultures	The student defines the strategy to solve the problem belonging to the mechanical-medical scope by considering social and ecological factors			[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice [SK3] Assessment of ability to organize work		
	[K7_W06] He/she in-depth knowledge related to construct, design and build of mechanical devices and mechanical-medical devices	To solve a given problem the student derive a solution by considering knowledge related to the construction and design of mechanical – medical devices.			[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	[K7_K01] He/she is aware to acquire the knowledge through the whole life, is able to inspire and to organize to teach himself/herself and others in cooperation and in leading position	The student defines the strategy to acquire needed additional knowledge that allows him to solve basic scientific problem			[SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice		

## Subject contents

### Lectures (DSc PhD Wiktoria Wojnicz) (30h):

Tensor calculation fundamentals.

Fundamentals of elasticity theory: 3D stress state, Navier equation, boundary task in stress state and in the displacement state.

Fundamentals of elasticity theory; 3D strain state, constitutive relations.

Analysis of strain state by using strain gauge systems.

Deformable body mechanics: strain tensors.

Material models: orthotropic materials.

Modele materiałowe: modele stosowane do opisywania biomateriałów (w tym miękkich).

Fundamentals of composite materials modelling.

Finite Element Method (FEM) in engineering calculations: fundamental definitions. FEM: Truss element, Beam element, Membrane element.

Podstawy teorii plastyczności . Wytrzymałość prętów sprężysto-plastycznych.

Fatigue strength.

Fracture mechanics.

Contact stress.

Fundamentals of rheology.

Thin-walled structure in engineering calculations. Centre of shear estimation.

### Lab (PhD Alicja Stanisławska) (15h):

Estimation of hardness, reduced Youngs modulus, yielding strength and elastic strength in nanoindentation test.

Estimation of type and value of internal stress in tested material.

Fracture mechanics. Assessment of stress intensity factor.

Testing of strain rate during the creep of material.

Testing of hardness by using Brinell, Rockwell and Vickers methods.

Testing of impact strength of metallic sample covered by the oxygen layer.

Prerequisites and co-requisites	Skills on formulation of the static equilibrium conditions and dynamic equations. Skills on solution of ordinary and partial differential equations. Knowledge on Mathematics, Mechanics and Strength of Materials.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	50.0%	30.0%
	Written exam	50.0%	70.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>Bąk R., Burczyński T.: Wytrzymałość materiałów z elementami ujęcia komputerowego. Warszawa, WNT, 2001.</li> <li>Banasiak M., Grossman K., Trombski M.: Zbiór zadań z wytrzymałości materiałów. PWN, Warszawa, 1998.</li> <li>Ostrowska-Maciejewska J., Kowalczyk-Gajewska K.: Rachunek tensorowy w mechanice ośrodków ciągłych. Warszawa, Wydawnictwo IPPT, 2013.</li> <li>Sawicki A.: Mechanika kontinuum. Wprowadzenie. Gdańsk: Wydaw. Instytutu Budownictwa Wodnego PAN 1994.</li> <li>Wojnicz W., Wittbrodt E.: Mechaniczne Metody Badań Materiałów. Wydawnictwo Politechniki Gdańskiej, 2020, ISBN 978-83-7348-810-6</li> </ol>	
	Supplementary literature	<ol style="list-style-type: none"> <li>Gawęcki A.: Mechanika materiałów i konstrukcji prętowych. Poznań: Wyd. Politechniki Poznańskiej 1998.</li> <li>Rymarz Cz.: Mechanika ośrodków ciągłych. Warszawa: Wydaw. Naukowe PWN 1993.</li> <li>Kaliński K. J.: Nadzorowanie procesów dynamicznych w układach mechanicznych. Gdańsk: Wydaw. Polit. Gdańskiej 2012.</li> </ol>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Describe parameters used to assess properties of material during fracture developing		
Work placement	Not applicable		