Załącznik nr 2 do Zarządzenia Nr 16/2022 Rektora PB

COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Bialystok University of Technology
Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Biomedical Engineering</td><td>Degree level and programme type</td><td>Full-time studies
First cycle</td></tr>
<tr><td>Specialisation/ diploma path</td><td colspan="6">-</td><td>Study profile</td><td>elective</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Tissue mechanics</td><td>Course code</td><td></td></tr>
<tr><td>Course type</td><td>Elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of educational activities</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>-</td></tr>
<tr><td>30</td><td></td><td>15</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>3</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">The course aims to familiarize students with the fundamental principles of tissue mechanics, focusing on the mechanical behavior of biological tissues and their applications in biomedical engineering.
Students will gain knowledge about: the principles of stress, strain, elasticity, viscoelasticity, and other mechanical properties relevant to biological tissues; mechanical behavior of tissues; constitutive models; experimental techniques; structure-function relationships.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: introduction to tissue mechanics (overview of biomechanics and its significance in biomedical engineering; basic concepts of mechanics: stress, strain, elasticity, viscoelasticity); mechanical behavior of biological tissues (structure and function of bone, cartilage, tendons, ligaments, and muscles); mechanical characterization of soft and hard tissues; load-bearing capacity and failure mechanisms of biological tissues; constitutive modeling of tissues (linear and nonlinear elasticity in biological tissues; viscoelasticity: time-dependent mechanical behavior; poroelasticity and biphasic models in soft tissues); experimental techniques in tissue mechanics (mechanical testing of biological tissues; indentation and nanoindentation techniques; rheometry and dynamic mechanical analysis); structure-function relationships in tissues (collagen, elastin, and other structural components of tissues; the influence of microstructure on mechanical properties; adaptation of tissues to mechanical loading)
Laboratory classes: experimental evaluation of bone tissue mechanical properties (limit of strength, hardness, Young’s modulus), studies on tendon stress relaxation properties, bone-tendon unit mechanical testing</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Informative-problem lecture;
Laboratory classes: exercises and measurements using specialized equipment,</td></tr>
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	solving practical problems in groups	
Assessment method	Lecture: exam. Laboratory classes: evaluation of entry tests, reports, discussions and activity in the course.	
Symbol of learning outcome	**Learning outcomes**	**Reference to the learning outcomes for the field of study**
	Knowledge: the graduate knows and understands	
LO1	the principles of stress, strain, elasticity, viscoelasticity, and other mechanical properties relevant to biological tissues	IB1_W01
LO2	how the composition and organization of biological tissues influence their mechanical behavior	IB1_W01
	Skills: the graduate is able to	
LO3	describe the structure and function of various biological tissues (e.g., bone, cartilage, tendons, ligaments, muscles) and their response to mechanical loading.	IB1_U05
LO4	mathematical models, including linear and nonlinear elasticity, viscoelasticity, and poroelasticity, to describe tissue mechanics.	IB1_U05
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	Exam	L
LO2	Exam	L
LO3	Laboratory classes: assessment of tests, reports, discussions, and participation in classes	LC
LO4	Laboratory classes: assessment of tests, reports, discussions, and participation in classes	LC
Student workload (in hours)		**No. of hours**
Calculation	Participation in lectures	30
	Participation in laboratory classes	15
	Preparation for the lecture assessment	4
	Preparation for laboratory classes	6
	Preparation of laboratory reports	15
	Participation in consultations	5
	TOTAL:	75
Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**50**	**2**
Student workload – practical activities	**41**	**1,64**
Basic references	1. Cowin, S. C., Doty, S. B., Tissue Mechanics, Springer, 2007 2. Fung, Y. C., Biomechanics: Mechanical Properties of Living Tissues, Springer, 1993	

	3. Hall B.K., Bones and Cartilage. Developmental and Evolutionary Skeletal Biology, Elsevier 2015 4. Ethier C.R., Simmons C.A.: Introductory Biomechanics, From Cells to Organisms, Cambridge University Press, 2007 5. Vernerey, F. J., Mechanics and Physics of Soft Biological Tissues, CRC Press, 2022	
Supplementary references	1. Journal of Biomechanics, Elsevier (journal) 2. Mow, V. C., Huiskes, R., Basic Orthopaedic Biomechanics & Mechano-Biology, Lippincott Williams & Wilkins, 2005	
Organisational unit conducting the course	Institute of Biomedical Engineering	**Date of issuing the programme**
Author of the programme	Assoc. Prof. Eng. Szczepan Piszczatowski Dr. Eng. Piotr Prochor	4.03.2025

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar