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
Second 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">Mechanobiology</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>15</td><td></td><td></td><td></td><td>30</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 mechanical mechanisms governing biological processes and their significance in health and disease. Students will gain knowledge about: the fundamental principles of mechanobiology and their relevance in physiology and pathology; research methods used in mechanobiology, including computational models; applications of mechanobiology in regenerative medicine, tissue engineering, and therapies for mechanically dependent diseases.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: introduction to mechanobiology (definition, scope, and interdisciplinary nature of mechanobiology; importance of mechanical loadings in biological systems; role of mechanobiology in health and disease); fundamental Principles of Mechanobiology (cellular and tissue-level biomechanics; mechanical properties of cells and extracellular matrix; mechanotransduction: conversion of mechanical stimuli into biological signals); mechanobiology in physiology and pathology (influence of mechanical forces on cellular function and tissue homeostasis; role of mechanobiology in developmental biology; mechanobiological factors in disease progression); research methods in mechanobiology (experimental techniques for mechanobiology; computational modeling and simulations); applications in regenerative medicine and tissue engineering (role of mechanical forces in stem cell differentiation; scaffold design and biomaterials for tissue regeneration; bioreactors and mechanobiological conditioning for engineered tissues); therapies for mechanically dependent diseases (mechanobiology-based approaches to treat musculoskeletal disorders; cardiovascular applications: emerging trends in mechanobiology-driven therapeutic strategies).
Specialized workshop: Use of methods and specialized software for preparing geometric and material models of anatomical objects based on imaging data, modeling and numerical analysis using the finite element method.</td></tr>
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Teaching methods	Informative-problem lecture; Specialization workshop exercises using dedicated software: solving practical problems in groups	
Assessment method	Lecture: exam. Specialization workshop: assessment of completed tasks, ongoing progress, discussions, and class participation.	
Symbol of learning outcome	**Learning outcomes**	**Reference to the learning outcomes for the field of study**
	Knowledge: the graduate knows and understands	
LO1	the fundamental principles of mechanobiology and their role in physiological and pathological processes	IB2_W01
LO2	the significance of mechanobiology in regenerative medicine, tissue engineering, and the development of therapies for mechanically dependent diseases	IB2_W01
	Skills: the graduate is able to	
LO3	analyze biomechanical mechanisms governing biological systems and their impact on cellular and tissue function in health and disease	IB2_U06
LO4	apply research methods used in mechanobiology, including computational models, to investigate mechanobiological phenomena	IB2_U06
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	Specialization workshop: assessment of completed tasks, ongoing progress, discussions, and class participation.	SW
LO4	Specialization workshop: assessment of completed tasks, ongoing progress, discussions, and class participation.	SW
Student workload (in hours)		**No. of hours**
Calculation	Participation in lectures	15
	Participation in specialization workshop	30
	Preparation for the lecture assessment	4
	Completion of specialized workshop tasks	6
	Preparation for the assessment of specialized workshop tasks	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	**56**	**2,24**

Basic references	1. Nagatomi J., Mechanobiology handbook, CRC Press, Boca Raton, 2017 2. Ethier C.R., Simmons C.A.: Introductory Biomechanics, From Cells to Organisms, Cambridge University Press, 2007 3. Mofrad M.R.K., Kamm R.D.: Cytoskeletal Mechanics, Models and Measurements in Cell Mechanics, Cambridge University Press, 2006 4. De S., Guilak F., Mofrad M.R.K., Computational Modeling in Biomechanics, Springer, 2010 5. Nedoma J., Stehlik J., Mathematical and computational methods in biomechanics of human skeletal systems: an introduction, Wiley, 2011	
Supplementary references	1. Biomechanics and Modeling in Mechanobiology, Springer (journal) 2. International Journal for Numerical Methods in Biomedical Engineering, Wiley (journal) 3. Computer Methods in Biomechanics & Biomedical Engineering, Taylor & Francis (journal)	
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