GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Biomechanics, PG_00064132		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	8.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Applied Mechanics and Biomechanics -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Wiktoria Wojnicz	
	Teachers	dr hab. inż. Wiktoria Wojnicz dr inż. Wiktor Sieklicki mgr inż. Katarzyna Pytka mgr inż. Natalia Szarwińska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	30.0	0.0	0.0	90

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	90	10.0	100.0	200

Subject objectives

The aim of this subject is to acquire knowledge about the human body biomechanics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] is able to utilize empirical, analytical, simulation, and computer-based methods to formulate and solve engineering tasks in the field of medical and mechanical engineering	A student can elaborate a biomechanical model, define input and output data, specify which engineering tools should be used to solve the given problem	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_W03] has knowledge in rigid body mechanics, biomechanics, modelling of mechanical system, vibration and strength analysis of mechanical structures or knowledge in the use of computer programs for analyzing and simulating mechanical systems, and the design process	A student can formulate a biomechanical problem and the method of solving this problem by using fundamentals of mechanics, strength of materials, biomechanics and modelling of mechanical system	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents	Course content – lecture **Lectures (30h)** Health and safety regulations in biomechanical studies (Laboratory of Biomechanics) Biomechanics and clinical biomechanics. Principles of mechanics used to describe the activity of the human body. Mobility of biokinematic chain. Reference systems used in biomechanics. Standard anatomical position. Types of human motions. Fundamentals of estimation of of position of centre of human body mass (de Levas method). Biomechanics of muscle. Biomechanics of muscles system. Principles of electromyography measurement. Static biomechanical models. Dynamic biomechanical models. Biomechanics of bone. Cantilevers of skeletal system. Modelling of remodelling phenomenon of bone tissue. Biomechanics of chondral tissue. Biomechanics of joints. Principals of neurophysiology and movement coordination. Principles of biomechanics of gait. Biomechanics of hip joint. Models of hip joint load. Problems of hip joint biomechanics. Alloplastic reconstruction of hip joint. Biomechanics of knee joint. Kinematics of knee joint. Fundamental problem of knee joint biomechanics. Alloplastic reconstruction of knee joint. Biomechanics of glenohumeral joint. Alloplastic reconstruction of glenohumeral joint. Biomechanics of elbow joint. Alloplastic reconstruction of elbow joint. Anatomy of spine. Defects of postures and scoliosis. Methods of spine testing. Biomechanics of spine. Systems of spine stabilization. Biomechanics of the human chest. Course content – exercises **Tutorials (30h)** Assessment of mobility of biokinematics chain Estimation of position of center of the human body Demonstration of application of SMART software to elaborate biomechanical experimental data. Statics biomechanical models: assessment of joint load and muscles participation in the given performance of the upper/lower limb Estimation of moments of inertia of the human body parts

Dynamics biomechanical models: assessment of joint load and muscles participation in the given performance of the upper/lower limb

Test 1

Test 2

Repeat test

Course content – laboratory
Labs (30h)

Lab 1: ***Analysis of neuromuscular activity of chosen muscles of upper limb under the given external load*** (experimental testing, data processing, results' elaboration, report elaboration)

Lab 2: ***Ergonomic analysis of everyday activities by using EMG and BTS systems*** (experimental testing, data processing, results' elaboration, report elaboration)

Lab 3: ***Influence of physical activity on a gait pattern*** (experimental testing, data processing, results' elaboration, report elaboration)

Prerequisites and co-requisites

Knowledge of mathematics, ,mechanics and strength of materials

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tutorials passing	50.0%	30.0%
lectures passing	50.0%	40.0%
labs passing	50.0%	30.0%

Recommended reading

Basic literature	A.Chapman - Biomechanical analysis of fundamental human movements - Human Kinetics (2008) VM.Zatsiorsky - Kinetics of human motion - Human Kinetics (2002) A.Tozeren - Human body dynamics - Classical mechanics and human movement - Springer (2000)
Supplementary literature	Wojnicz W., Wittbrodt E., Modele dyskretne w analizie dynamiki mięśni szkieletowych układu ramię-przedramię (*Discrete models in dynamic analysis of skeletal muscles of the arm-forearm system*). Wydawnictwo Politechniki Gdańskiej, 2012, p. 1-212, ISBN 978-83-7348-424-5 Wojnicz W., Biomechaniczne modele układu mięśniowo-szkieletowego człowieka (*Biomechanical models of the human musculoskeletal system*). Wydawnictwo Politechniki Gdańskiej, 2018, p. 1-209, ISBN 978-83-7348-727-7
eResources addresses	

Example issues/ example questions/ tasks being completed

Describe biomechanical analysis of musculoskeletal system of the upper limb and lower limb

Practical activites within the subject

Not applicable

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