GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Biomechanics , PG_00055757		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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 None
Semester of study	4	ECTS credits	8.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	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	mgr inż. Katarzyna Pytka dr inż. Wiktor Sieklicki 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	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_W05] he/she has skills in the field mechanics od rigid body, modelling of mechanical system, vibration and fundamental of strength of materials	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
[K6_U05] he/she is able to use analytic and modelling methods to formulate and solve engineering tasks related to the mechanical-medical area	A student can formulate 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

Subject contents	**Lectures (30h) (DSc PhD Wiktoria Wojnicz):** 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).Statics biomechanical models. Dynamics biomechanical models.Biomechanics of muscle. Biomechanics of muscles system.Principles of electromyography measurement.Biomechanics of bone. Modelling of adaptation remodelling phenomenon of bone tissue. Methods of modelling of bone functional adaptation. Cantilevers of skeletal system.Biomechanics of chondral tissue. Biomechanics of joints.Reflex functioning of nervous system. Principals of movement coordination.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 ankle joint and foot. Osteosynthesis. Stabilizers used to stable osteosynthesis. Mechanical properties of stabilizers used to stable osteosynthesis. Types of stabilizers used to stable osteosynthesis.Biomechanics of the human chest. **Tutorials (30h) (PhD Wiktor Sieklicki):** Assessment of mobility of biokinematics chainEstimation of position of center of the human bodyStatics biomechanical models: assessment of joint load and muscles participation in the given configuration and load of the upper limbStatics biomechanical models: : assessment of joint load and muscles participation in the given configuration and load of the lower limbEstimation of moments of inertia of the human body partsDynamics biomechanical models: assessment of joint load and muscles participation in the given performance of the upper limbDynamics biomechanical models: : assessment of joint load and muscles participation in the given performance of the lower limbTest 1Test 2Repeat test **Labs (30h) (PhD Wiktor Sieklicki, MSc Katarzyna Forysiak):** 1. Health and safety regulations in biomechanical studies. Introduction to biomechanical testing2. Kinematics analysis by using inertial system3. Kinematics analysis by using optical system4. Kinematics analysis and EMG testing of upper limb in the given motor performances5. Kinematics analysis and EMG testing of lower limb in the given motor performances6. Experimental estimation of position of center of the human body7. Presentation of raports
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
lectures passing	50.0%	40.0%
labs passing	50.0%	30.0%
tutorials 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	Adresy na platformie eNauczanie: Biomechanika,Wykład,IMM,letni 2022-2023 (PG_00055757) - Moodle ID: 28919 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28919
Example issues/ example questions/ tasks being completed	Describe biomechanical analysis of musculoskeletal system of the upper limb and lower limb	
Work placement	Not applicable	

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