Subject: Biomechanics

I. General information

Organization unit	Faculty of Rehabilitation Department of Natural Sciences Head: dr hab. Professor AWF Ida Wiszomirska
Course name	Biomechanics
Subject code	FV-11
Teaching language	English
Type of subject (obligatory/ facultative)	Obligatory
Level of studies	Long-cycle master's
Study year	II
Semester	III
ECTS points	2
Teacher/ e-mail	dr hab. prof. AWF Michalina Błażkiewicz, michalina.blazkiewicz@awf.edu.pl
Studies program in which the subject is realized	Physiotherapy
Method of realization (stationary/ distance learning)	Stationary
Prerequisites	Before starting the module, the student has knowledge of: biophysics, normal and X-ray anatomy, functional anatomy, biochemistry.

II. Detailed Information

Course aims and objectives

A1	To acquaint the student with the terminology occurring in the biomechanics of the human musculoskeletal system.
A2	To acquaint the student with the mechanical properties of the passive elements of the human locomotors system.
A3	To acquaint the student with the mechanical properties of the muscular system.
A4	To acquaint the student with the methods of measuring the mechanical properties of the human motion system.

Learning outcomes

Learning outcome	Subject's learning outcomes
Knowledge	
O.W4. basis of the mechanical forces impact on the human body of a healthy and sick person, including the elderly, with various dysfunctions and diseases, in various conditions; A.W4. basic physical properties, structure and functions of human body cells and tissues; A.W12. legal and economic aspects of the functioning of entities involved in the rehabilitation process of people with disabilities; A.W13. ethical, legal and social issues of physiotherapist profession.	1. Has knowledge of methods of assessing the human locomotors system to explain disorders of their structure and function. 2. Has knowledge of biomechanical analysis of simple and complex human movements. 3. Knows and interprets physical phenomena occurring in the system under the influence of external factors.
Skills	
O.U9. plan their own educational activity and constantly improve their knowledge to update it; A.U10.; encourage others to learn and take part in physical activity; A.U11. communicate with the patient and their family in an atmosphere of trust, taking into account the needs of the patient and their rights.	1. Is able to carry out measurements of joint moments in static conditions and interpret the obtained results. 2. Is able to prepare the workplace and operate the apparatus for measuring joint moments, balance as well as jump and gait reaction forces. 3. Is able to interpret the obtained results of biomechanical tests.
Social Competences	

O.K4. compliance with patients' rights and professional ethics;	1. Knows health and safety rules regarding behavior in clinical conditions affecting patient and patient safety.
O.K5. perceive and recognize their own limitations, self-assessing deficits and educational needs;	2. Is able to make good contact with the patient.
	3. Has the ability to communicate effectively.
O.K6. use objective sources of information;	4. Understands the need for lifelong learning and the need for lifelong learning and professional development.
O.K9. take responsibility related to decisions taken as part of the professional practice, as well as those of self and other people's safety.	

Syllabus contents

No.	Lecture title
Classes/ Practical classes	
1	Introduction to biomechanics. Discussion of the basic concepts of mechanics.
2	Biomechanical analysis of the structure of the osteoarticular system. Degrees of freedom, axes of rotation in the joints. Kinematic pairs and chains.
3	Theory of muscle contraction. Muscle strength and its dependence on various parameters.
4	Modeling of single muscle properties.
5	Biomechanical analysis of the structure and function of the foot.
6	Biomechanical analysis of the structure and function of the knee.
7	Biomechanical analysis of the structure and function of the hip.
8	Biomechanical analysis of the structure and function of the spine.
9	Biomechanical analysis of uncontrolled falls.
10	Gait analysis.
11	Gait analysis – kinematics parameters.
12	Gait analysis – kinetics parameters.
13	Application of advanced statistical methods in biomechanics.
14	Modeling and modern research directions in biomechanics - part I.

15	Modeling and modern research directions in biomechanics - part II.
16	Basic laws and quantities of mechanics. To acquaint students with the principles of health and safety at the Biomechanics studio and laboratory.
17	Basic laws and magnitude of mechanics - problems solving.
18	Determination of center of mass for individual parts of the human body. Analytical method for determining the general center of gravity of the human body.
19	Muscle strength and its dependence on various parameters. The action of muscle strength on bone levers.
20	Definition of joint moments. Calculation of the joint moment relative to the axis of rotation. Changes in the value of joint moment under the influence of external loads and depending on the angle of the joint.
21	Measurements of the maximum joint moments in static conditions.
22	Assessment of the balance mechanism on the stabilographic platform.
23	Jumping assessment on a dynamometric platform. Energy characteristics of movements using the stretch-contraction sequence.
24	Assessment of the relationship between power and speed.
25	Registration of muscle bioelectrical activity (EMG) in static and dynamic conditions.
26	Analysis and methods of EMG signal processing.
27	Measurement and analysis of ground reaction forces during gait.
28	Basic mechanical parameters describing human gait.
29	Measurements of spatio-temporal gait parameters.
30	Interpretation of various biomechanics parameters in various movement.

Assessment criterion

Local grade	Grade	Criteria
5	A	90% of final test
4,5	B	80% of final test
4	C	70% of final test
3,5	D	60% of final test
3	E	50% of final test
2	F	< 50% of final test

1ECTS point = 30 hours students work (contact + self study)

TYPES OF CLASSES	HOURS
Contact hours	45
Self study	15
Total = 60 hours. = 2 ECTS	