COURSE DESCRIPTION CARD - SYLLABUS

Course name
Biomechanical engineering [S1IBio1>BI]

Course

Field of study
Biomedical Engineering

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of anatomy, mechanics and strength of materials.

Course objective

Acquisition of knowledge on the structure and mechanical properties of tissues of human motion system. Acquisition of skills of modelling of biomechanical systems and systems for analysis of the pathological and normal human gait.

Course-related learning outcomes

Knowledge:
1. To know the structure and mechanical properties of muscles, tendon, ligaments and bones of the human motion system.
2. To know the basic knowledge on the mechanical strength of human tissues.
3. To know the anatomy, function and biomechanics of the spine and the models for the determination of the forces exerted in the spine.
4. Knowledge of the anatomy, functions and biomechanics of joints: hip, knee and elbow. Knowledge of mathematical models for determination of forces exerted in joint tissues during various activities.

5. Knowledge of various approaches in modelling of human activities.

Skills:
1. To carry out experiments to determine biomechanical parameters of human motion. To interpret results and formulate conclusions.
2. To operate BTS system for human gait analysis, electromyograph, dynamometric platforms, the use of computer software for analysis, interpret and error estimation.
3. To exploit relevant analytical, numerical and experimental methods to formulate and solve engineering problems.
4. To assess the forces exerted in human tissues.

Social competences:
1. The student understands the need of life-long learning, of inspiring and organising other person's teaching process.
2. Is aware of the importance of engineering knowledge and its significance for society and environment.
3. Understands the need for popularisation of knowledge of biomedical engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory: Reports of the laboratory practices executed and tests of the knowledge written before each laboratory class.
Lecture: Theoretical questions (plus presence on the lectures): criteria of assessment: >50% – ndst., 50%÷59% – dst, 60%÷69%– dst+, 70%÷79%. – db, 80%÷89% – db+, 90%÷100% – bdb).

Programme content

Lecture
Structure of the human motion system: bone system. Mechanical properties of the tissues of the human motion system. Spine - anatomy, functions, force models. Spine stabilisation. Anatomy, functions and models for determination forces exerted in tissues of chosen joints.
Laboratory
Biomechanical analysis of human gait using the BTS SMART DX system, dynamometric platforms and electromyographic signal measurements. Selected issues in human body statics, kinematics and dynamics for different motor activities.

Course topics

Lecture
1. Introduction to engineering biomechanics.
2. Structure of the human motion system: bone system in technical aspect, mobility of chosen motion units, muscle system, as a drive of the body.
3. Mechanical properties of the tissues of the human motion system.
4. Biomaterials.
5. Spine - anatomy, functions, force models. Spine stabilisation.
6. Hip joint - anatomy, functions and models for determination forces exerted in tissues.
7. Knee joint - anatomy, functions and models for determination forces exerted in tissues.
8. Elbow joint - anatomy, functions and models for determination forces exerted in tissues.
9. Chosen aspects of joints alloplasty.
Laboratory
1. Determination of centres of masses of body and segments of its own. Determination of torques exerted in joints.
2. Kinematics of joints.
3. Analysis of biomechanical parameters of jump.
4. Biomechanical analysis of human's gait.
5. Registration and analysis of electromyographic signal of muscle tissue in various phases of activity.

Teaching methods

1. Lecture: the presentation ilustrated with examples and problems solutions written down on the

blackboard.
2. Laboratory: experiments, reports of the experiments, discussion.

Bibliography

Basic:
1. Engineering biomechanics – selected problems (Biomechanika inżynierska - zagadnienia wybrane), Będziński R., Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 1997.
2. Biomechanics of motion systems (Biomechanika narządów ruchu), praca zbiorowa pod redakcją D. Tejszerskiej, E. Świtońskiego, M. Guzika, Wydawnictwo Naukowe Instytut Technologii Eksploatacji – PIB, Radom, 2011.
3. Biocybernetics and biomedical engineering 2000 (Biocybernetyka i inżynieria biomedyczna 2000), pod redakcją Macieja Nałęcza, Akademicka Oficyna Wydawnicza, Warszawa, 2004.

Additional:
1. Human anatomy (Anatomia człowieka), Bochenek A., Reicher M., Wydawnictwo Lekarskie PZWL, Warszawa, 1990.
2. Biomechanics of human motion system (Biomechanika układu ruchu człowieka), Bober T., Zawadzki J., Wydawnictwo BK, Wrocław, 2001.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00