COURSE DESCRIPTION CARD - SYLLABUS

Course name
Human in a technical system [S2IBio1-BiIW>CwST]

Course

Field of study
Biomedical Engineering

Year/Semester
2/3

Area of study (specialization)
Bionics and Virtual Engineering

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

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

Knowledge: Has basic knowledge of computer-aided engineering methods, computer-aided design, anthropometry and human body anatomy. Skills: Logical thinking, using information obtained from the library, the Internet and other sources. Social competences: Understanding the need to learn and acquire new knowledge.

Course objective

Acquiring knowledge about the importance and place of man in the technical system and the possibilities of computer-aided analysis of man-machine interaction (environment). Learning about systems for measurement of human body movement and parameters (Motion Capture systems), data capture of human body spatial movements, data recording formats and their processing by specialised software. Introduction to basic methods of capturing human movements and processing of measurement data. To gain knowledge about integration of technical and biomimetic structure models with human body models and to conduct computer simulations using them.

Course-related learning outcomes

Knowledge:

The student has knowledge of development trends and the most important new achievements in the fields of science and scientific disciplines relevant to the field of study being studied and related scientific disciplines.
The student knows the basic methods, techniques, tools and materials used to solve complex engineering tasks in the field of study being studied.

Skills:
The student is able to plan and carry out experiments, including computer measurements and simulations, interpret the results obtained and draw conclusions.
The student is able to assess the usefulness and possibility of using new achievements (techniques and technologies) in the field of study.

Social competences:
The student is able to interact and work in a group, taking on different roles.
Is ready to critically assess knowledge and received content.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Rating individual work related to the operation of different measuring systems (measurement of human body movement) and a dedicated data processing software.
Obligatory reports on laboratory classes - one report within a single position group.
Practical tests of the tasks set before the student on the ability to work with the computer model of a human being and the Motion Capture system.
Final test of theoretical knowledge - written form, duration 1.5 h. The test is conducted after the whole lecture cycle. It includes at least three questions, one question each on the knowledge of basic definitions concerning computer models of humans, construction and principles of operation of the selected Motion Capture system and computer aided ergonomics systems. Passing threshold: 50% of points.

Programme content

Presenting basic relationships in the human-machine system. Presenting basic definitions in the field of Motion Capture systems and computer models of humans. Present the division and types of Motion Capture systems. Discuss the principles of the functioning of the Motion Capture system on the example of the "exoskeleton", the system based on IMU sensors and measurement gloves. Demonstrate to students the process of capturing a sequence of human body movements on a laboratory workstation. Analysis and processing of the obtained measurement data in specialised computer programmes. Presenting basic functions of virtual analysis of human-machine interaction on the example of CATIA program - module "Human Ergonomics Design and Analysis" and based on Blender software. Introduction to the construction of a computer model of man, simulation of human-machine interaction and posture analysis. Overview of the elements and steps of computer simulation of human-machine interaction (in particular of a biomedical device). Simulation and verification of a model of a technical object based on biological models or a biomedical device in interaction with a human body model..

Course topics

none

Teaching methods

1. Lecture with multimedia presentation
2. Laboratory exercises: multimedia presentation, performing practical tasks given by the lecturer, realization of an individual computer simulation

Bibliography

Basic:
1. Wprowadzenie do inżynierii rehabilitacyjnej : praca zbiorowa, Pod. Red.: Marek Zabłocki, Wydawnictwo Politechniki Poznańskiej, 2017, ISBN: 978-83-941828-1-6.

2. Winkler T.: Komputerowo wspomagane projektowanie systemów antropotechnicznych, WNT Warszawa 2005
3. Tejszerska D., Świtoński E.: Biomechanika inżynierska - zagadnienia wybrane laboratorium. Wydawnictwo Politechniki Śląskiej, Gliwice 2004
4. Jabłoński J.: Ergonomia produktu. Ergonomiczne zasady projektowania produktów. Wydawnictwo Politechniki Poznańskiej, Poznań 2006

Additional:
1. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000
2. Pięciak T., Pawłowski R., Wizualizacja ruchu człowieka (Motion Capture), Inżynierowie dla Biologii i Medycyny : kwartalnik wykładowców i studentów inżynierii biomedycznej ; ISSN 1897-9149. -2009 nr 5
3. Nowak E.: Atlas antropometryczny populacji polskiej - dane do projektowania, Instytut Wzornictwa Przemysłowego, Warszawa 2000

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