COURSE DESCRIPTION CARD - SYLLABUS

Course name
3D scanning in biomedical applications [S2IBio1E-IIiP>SPwZB]

Course

Field of study
Biomedical Engineering

Year/Semester
2/3

Area of study (specialization)
Engineering of Implants and Prosthesis

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

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: It has a basic knowledge of the following methods: computer aided design - CAD, solid modelling of construction in CAD systems, the basic measurement methods in the field of geometric metrology Skills: He can plan and carry out measurements, computer simulations and interpreted the results Social competencies: He can interact and work in a group.

Course objective

Acquiring knowledge about the importance and possibilities of Reverse Engineering in the aspect of medical applications and biomedical engineering. Acquainting with the basic methods of 3D scanning of biomedical objects, such as skeletal bones (using anatomical casts and 3D prints), limbs and elements of the human body (such as face, ears, etc.) and with the processing of the obtained measurement data. Acquiring the ability to select the right biomedical device (3D scanner) and the ability to apply an appropriate strategy for the data acquisition (scanning) process, adequately to the type and specificity of the scanned biomedical object.

Course-related learning outcomes

Knowledge:

Knows the modern methods of engineering computer graphics and the theoretical foundations of engineering calculations using the finite element method.
Has general knowledge about the types of tests and methods of testing working machines using modern measuring techniques and data acquisition.

Skills:
The student is able to plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions.
Student is able to carry out basic measurements of mechanical quantities on the tested working machine using modern measuring systems.

Social competences:
The student is able to interact and work in a group, assuming various roles in it.
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:
Assessment of individual work related to the operation of various scanning systems (methods: laser, structured light, contact), measurements and reconstruction of geometry of biomedical objects in specialized software for Reverse Engineering (Reverse Engineering).
Practical tests of the tasks set for student regarding the ability to work with a given type of 3D scanner and biomedical objects - conducted every second week of lectures.
Obligatory reports on laboratory activities - one report within a single work group (applies to a laboratory).
Lecture: Final colloquium on theoretical and practical knowledge - written form duration 1.5h, conducted after the whole cycle of lectures. It covers a minimum of three topics, one from each thematic block, i.e. knowledge of: basic definitions concerning Reverse Engineering, measurement methods used in 3D scanners, construction and principle of operation of a selected spatial scanner, methods of 3D geometry reconstruction of biomedical objects on the basis of data from spatial scanners. The different elements of the colloquium are graded on a point scale, at least 50% of the total score is required to pass the colloquium.
Laboratories: reports on completed laboratories, assessment of activity in class, questions during laboratories. Points are awarded for these elements. Passing of laboratories when a minimum score of 50% of the total points is exceeded.

Programme content

Presentation of basic definitions in the field of Reverse Engineering and 3D scanning. Presentation of the main types of 3D scanners, taking into account the measurement methodolgy, range of operation and special-purpose of devices. Detailed description of the construction and operation of 3D scanners: contact, laser, structured light, as well as photogrammetric methods. Acquainting with the techniques of measuring biomedical objects at laboratory stands equipped with 3D scanners: contact, laser and structured light. Introducing students to the process of reconstructing the geometry of scanned objects depending on the type of data obtained and the type of biomedical object. Acquainting with the methods of geometry reconstruction and data processing from a point cloud to a NURBS surface.

Course topics

none

Teaching methods

1. Lecture with multimedia presentation.
2. Laboratory exercises: multimedia presentation, performance of tasks given by the teacher using 3D scanners and specialized software for Reverse Engineering, implementation of individual measurement tasks indicated by the teacher of 3D biomedical objects.

Bibliography

Basic
1. Chlebus. E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000
2. Jakubiec W., Malinowski J.: Metrologia wielkości geometrycznych, WNT Warszawa 2007
3. Butowtt J., Kaczyński R.: Fotogrametria, Wojskowa Akademia Techniczna 2003
Additional
Lecture materials and other thematic articles provided by the lecturer.

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