COURSE DESCRIPTION CARD - SYLLABUS

Course name
Reverse engineering and 3D scanning of biological objects

Course

Field of study
Biomedical engineering
Year/Semester
1/2
Area of study (specialization)
Bionics and virtual engineering
Profile of study
general academic
Level of study
Second-cycle studies
Course offered in
Polish
Form of study
full-time
Requirements
elective

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
dr hab. inż. Michał Rychlik
email: michal.rychlik@put.poznan.pl
tel. 61 665 2167
Institute of Applied Mechanics
Faculty of Mechanical Engineering
ul Jana Pawła II 24, 60-965 Poznań

Responsible for the course/lecturer:

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: Understands the need to learn and acquire new knowledge.

Course objective

Acquiring knowledge about the importance and possibilities of Reverse Engineering in terms of applications of building devices and machines based on living organisms and biomedical engineering. Introduction to basic methods of spatial scanning of biological and medical objects (such as bones of the

skeleton, body surface geometry, organic elements). Introduction to 3D scanning of machine objects. Learning the methods of processing and manipulating the obtained measurement data with the use of specialised software for reverse engineering. The ability to choose the right equipment (3D scanner) and the ability to apply the appropriate strategy for data acquisition (scanning), depending on the type and specificity of the bilogical, medical or mechanical object scanned.

Course-related learning outcomes

Knowledge

Has basic knowledge of engineering design and engineering graphics, allowing to design objects and processes, systems in a systemic approach, machine elements; to formulate and analyse problems; to search for solution concepts in the aspect of biomedical constructions.

Has a basic knowledge of the development trends of computer-aided engineering design in the field of biomedical engineering, thanks to which he/she can describe and present ways of recording structures, principles of mapping and dimensioning, application of computer graphics in the process of creating technical documentation and recording biomedical objects.

Skills

Can plan and carry out experiments, including measurements and computer simulations, interpret the results obtained and draw conclusions.

Can carry out measurements of physical and non-electrical quantities, as well as apply sensors of relevance to biomedical engineering, analyse data obtained by digital signal processing and operate specialised measuring apparatus.

Social competences

Is able to set priorities for the realization of a task defined by oneself or others.

Is able to cooperate and work in a group, assuming various roles in it.

Methods for verifying learning outcomes and assessment criteria

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 reconstructions of the geometry of biological, medical or machine objects in specialised Reverse Engineering software.

Practical tests of the student's tasks concerning the ability to work with a given type of 3D scanner and a biological, medical or mechanical object - conducted in the final part of a given thematic block (refers to the laboratory).

Obligatory reports on laboratory activities - one report within a single work group (applies to a laboratory).

Final exam/test of theoretical knowledge - written form, duration 1.5h, conducted after the entire cycle of lectures. It includes a minimum of three issues, 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 3D scanner, methods of 3D geometry reconstruction of biomedical objects on the basis of data from spatial scanners.

Programme content

Presentation of basic definitions in the field of Reverse Engineering and 3D scanning. Presentation of the methods used to acquire and process 3D geometry data. 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. Introduction to techniques of measuring biological, medical and machine objects on laboratory workstations equipped with 3D scanners: contact, laser and structured light. To introduce students to the process of reconstructing the geometry of scanned objects depending on the type of acquired measurement data and the type of biological, medical or machine object. Introduction to methods of geometry reconstruction and data processing from point clouds to NURBS surfaces..

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 biological, medical and mechanical.

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	75	3,0
Classes requiring direct contact with the teacher	38	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/examination, preparing a report on measurements made during laboratories - each time after completing a work cycle on a particular stand or a type of measuring device - 3D scanner))[1]	37	1,5

[1] delete or add other activities as appropriate