COURSE DESCRIPTION CARD - SYLLABUS

Course name
Automation of individualized medical products design [S2IBio1E-BiIW>APWM]

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
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 in scope of information technologies and technical drawing, CAD/CAM, manufacturing technologies; knowledge of medical imaging technologies; knowledge of medical products: orthopaedic and prosthetic equipment, implants, rehabilitation devices etc. Skills in solid modelling of an object in a CAD 3D system; designing a medical device. Social competences: cooperation in a project team, awareness of responsibility for assigned tasks, understanding the need for new knowledge.

Course objective

Getting familiarized with techniques and methods of automated design of individualized medical products, such as implants, prostheses, orthoses or rehabilitation devices, with use of knowledge engineering and intelligent CAD models.

Course-related learning outcomes

Knowledge:
1. Describes role of design in modern design engineering process.
2. Describes possibilities of design of individualized medical products using medical imaging techniques and 3D scanning.

3. Describes possibilities of automation of design of medical products with use of knowledge engineering and intelligent CAD models.

Skills:
1. Creates 3D models of individualized medical products on the basis of medical imaging/3D scanning data.
2. Prepares intelligent CAD models of individualized medical products with use of KBE techniques and uses these models to generate projects of medical products for specific patients.

Social competences:
1. Is open on implementation of advanced CAD systems in biomedical engineering.
2. Is able to develop knowledge on they own.
3. Is able to work in a project team using digital technologies.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Partial marks:
a) lectures:
- on the basis of answers to questions regarding material from previous lectures,
b) laboratory:
- on the basis of evaluation of current advancement in realization of given tasks,
Summary mark:
a) lectures:
- evaluation of knowledge by written final test with open and closed questions; questions are assessed on a point scale, and to pass it is required to collect at least 50% of the total possible number of points
b) laboratory:
- evaluation of progress in realization of laboratory exercises
- evaluation of results of a final assessment - an own intelligent model of a selected medical product
- to obtain a pass, it is necessary to complete all laboratory exercises (attendance + follow the instructions provided) and present to the tutor an own intelligent model, which will be assessed on a point scale (points are awarded for: compliance with the subject of the classes, functionality, degree of automation and resistance to errors) - it is necessary to obtain at least 50% of the points

Programme content

Lectures:
- mass customization in medical engineering - production of individualized supplies,
- types of individualized medical products, traditional and modern manufacturing technologies
- design of individualized medical products on the basis of medical imaging technologies and 3D scanning
- design automation techniques - basics of KBE (Knowledge Based Engineering) and auto-generating models in medical applications.
Laboratory - course:
- presentation of a process of rapid design and manufacturing of individualized medical products in Laboratory of Virtual Reality and Laboratory of Rapid Manufacturing,
- processing of medical imaging data and 3D scanning data (computer laboratory)
- design of selected medical products on the basis of medical imaging data (2-3 examples: pre-surgery supplies, implants , prostheses)
- creation of an intelligent CAD model of a selected medical product,
- (optionally) manufacturing of a prototype of a designed product using 3D printing or visualization using virtual reality

Course topics

none

Teaching methods

- informative lecture
- multimedia presentation

- case study
- laboratory method

Bibliography

Basic:
1. Skarka W., Catia v5. Podstawy budowy modeli autogenerujących. Helion, 2009

Additional:
1. F. J. Rybicki, G. T. Grant (Eds.), 3D Printing in Medicine: A Practical Guide for Medical Professionals, Springer 2017

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