COURSE DESCRIPTION CARD - SYLLABUS

Course name
Implants and artificial organs [S1IBio1E>IiSN]

Course

Field of study
Biomedical Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

Lecturers

Prerequisites

- Basic knowledge from biology and chemistry - The ability of logical thinking, obtaining information from the library and the Internet. - Understanding the needs for learning and gaining interdisciplinary knowledge.

Course objective

Learning the basics of the knowledge about artificial tissues, getting familiar with the methods of designing implants and 3D bio-printing.

Course-related learning outcomes

Knowledge:
1. Student should know the structure of the human body and the use of artificial tissues and organs in medicine.
2. Student should have knowledge about the design and production of implants and artificial organs.
3. Student should have knowledge of rapid prototyping and 3D bio-printing of artificial organs and implants.

Skills:
1. Student can acquire information regarding the area of medical knowledge.
2. Student is able to assess the medical conditions in the field of biomedical engineering.

3. Student is able to integrate the obtained information, interpret and draw conclusions.

Social competences:
1. Student is aware of the importance and understanding of non-technical aspects of engineering.
2. Student is able to set priorities for the implementation of a specific project.
3. Student is able to interact in a group, taking on different roles.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
Mark based on a test. Passing after correct answer to min. 50% of questions. Colloquium conducted at the end of the semester.
Project
Positive mark on the basis of a positive assessment of the final project report.

Programme content

Lecture
1. Introduction - the role of artificial organs and implants in modern medicine. Basic notions, classification, state of the art.
2. Implants, endoprostheses. Functions and types of endoprostheses. Materials used in the production of endoprostheses. Pharmaceutical and electronic implants.
3. Artificial organs: cochlear implant, pacemaker and cardiostimulator, artificial heart and heart-lung machine, bionic limb prostheses, other organs - selected problems.
4. Designing implants. Medical imaging processing. Mesh processing. CAD design.
5. Rapid Prototyping of implants and artificial organs. Methods: Fused Deposition Modeling (FDM). Sterolithography (SLA) / PolyJet / Digital Light Processing (DLP). Selective Laser Sintering (SLS) and similar methods.
6. 3D Bio-printing - principles, applications, state of the art, available processes. Bioinks.
7. Trends of development of implants and artificial organs and their manufacturing technologies.
Project
Students realize their own design of a prototype artificial organ through medical imaging processing and the use of selected techniques of additive manufacturing (3D printing). Framework project schedule:
1. Introduction - rules for completing the course, schedule of classes, division into groups, selection of topics.
2. Medical imaging segmentation using Invesalius software.
3. Mesh processing with GOM Inspect, Meshmixer. Getting to know the 3D scan - Einscan Pro.
4. CAD design in Inventor or any other system.
5. Manufacturing using FDM, SLA, Vacuum Casting methods.
6. Postprocessing, evaluation of the obtained objects, preparation of a project report.

Course topics

none

Teaching methods

1. Lecture: multimedia presentation.
2. Project - project method.

Bibliography

Basic:
1. The Basics of Artificial Organs Charles G. Gebelein, 1984
2. Biocybernetyka i inżynieria biomedyczna 2000, pod red. M. Nałęcza, t.3 Sztuczne narządy
3. Artificial Organs (journal) Wiley Online Library

Additional:
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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