COURSE DESCRIPTION CARD - SYLLABUS

Course name
Simulation and analysis of bionic structures [S2IBio1-IIiP>SiAKB]

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
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

2,00

Coordinators

dr hab. inż. Michał Rychlik prof. PP
michal.rychlik@put.poznan.pl

Lecturers

Prerequisites

Knowledge: Has a basic knowledge of computer-aided engineering methods, computer-aided design software. Skills: He can plan and carry out computer simulations, interpret the results obtained and draw conclusions. Social competencies: He understand the needs of learning and acquiring new knowledge.

Course objective

The aim of the course is to acquaint students with knowledge of biomechanical structures, their analysis and simulation. To gain knowledge of methods and processes related to modelling and computer simulation of bionic objects modelled on organic structures inspired by nature. Acquire practical knowledge and skills in the use of specialised CAx engineering software for modelling, analysis and simulation of bionic structures.

Course-related learning outcomes

Knowledge:
K_W05 - Has basic knowledge of engineering design and engineering graphics, allowing to design objects and processes, systems in terms of systems, machine elements; formulate and analyze problems; seek solutions concepts in biomedical construction.

K_W20 - has a basic knowledge of the development trends of computer-aided engineering design in the field of biomedical engineering, so that can describe and demonstrate ways of recording construction, mapping and dimensioning rules, the use of computer graphics in the creation of technical documentation and recording of biomedical objects.

Skills:
K2_U09 - be able to plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions.
K2_U13 - Can use analytical, simulation and experimental methods to formulate and solve engineering tasks and simple research problems in biomedical engineering.
K2_U22 - Can assess the suitability of methods and tools for solving an engineering task, characteristic of biomedical engineering, including recognising the limitations of these methods and tools; can - also using conceptually new methods - solve complex engineering tasks, characteristic of biomedical engineering, including atypical tasks and tasks with a research component.

Social competences:
K_K04 - Is able to set priorities for implementation specified by the tasks themselves or others.
K_K03 - Is able to interact and work in a group, assuming different roles in it.

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 use of specialist CAx engineering software.
Practical tests of the tasks set before the student for the modelling and simulation of bionic structures based on solutions from nature, in the context of mechanical and biomedical engineering.
Report on the implementation of the tasks set before the student in the laboratory.
Final assessment of the acquired knowledge and practical skills related to the implementation of the tasks. Pass mark: 50% of the points.

Programme content

Presentation and discussion of basic concepts and definitions in the field of methods of analysis and design of bionic and biomechanical structures are discussed.
Presentation and discussion of examples of modeling bionic structures and biomechanical systems using the finite element method.
Practical application of advanced functions of selected CAx tools and programs with particular emphasis on modelling of biomimetic structures and technical and biomedical objects.
Modelling of planar and spatial bionic and biomechanical systems in CAx engineering computer systems (such as SolidWorks, SolidWorks Simulation, SolidWorks Flow Simulation, Catia v5, Blender), FEA analysis and performing system modifications to obtain desired final parameters.

Course topics

none

Teaching methods

1. Lecture with multimedia presentation.
2. Laboratory classes: presentation of advanced methods and tools used in selected CAx systems, practical application of selected advanced techniques and performance of tasks given by the instructor, self-implementation and search for a solution to a given practical problem by selecting appropriate software and tools.

Bibliography

Basic
1. Akihiro Miyauchi, Masatsugu Shimomura, Industrial Biomimetics, Jenny Stanford Publishing, 2019, ISBN 9780429058837
2. John Willis, Sandeep Dogra," SOLIDWORKS Simulation 2019: A Power Guide for Beginners and Intermediate Users", CADArtifex, 2019. ISBN: 1798925478

3. G. Kazimierczak, B. Pacula, A. Budzyński: Solid Edge. Komputerowe wspomaganie projektowania, Wydawnictwo Helion 2004, ISBN: 83-7361-174-6
4. Tkacz E., Borys P., "Bionika", WNT, Warszawa, 2006
Additional
1. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000
2. Skarka, Wojciech: CATIA V5. Podstawy budowy modeli autogenerujących, Gliwice, Helion, 2008
3. Ben Simonds, Blender. Praktyczny przewodnik po modelowaniu, rzeźbieniu i renderowaniu, Helion, 2014, ISBN 9788324685714

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