COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modelling of bionic and organic structures [S2IBio1E-BiIW>MSBiO]

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

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

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

Lecturers

Prerequisites

Knowledge: It has a basic knowledge of the following methods: computer aided design - CAD, solid modelling of construction in CAD systems. Skills: He can plan and carry out measurements, computer simulations and interpreted the results Social competencies: He understand the needs of learning and acquiring new knowledge.

Course objective

Acquiring knowledge and skills in creating 3D models of technical and bionic objects modelled on organic structures inspired by nature. Create 3D geometries using advanced 3D modelling tools, in particular organic shaped objects, surface and hybrid modelling. Acquire practical knowledge and skills in the use of advanced tools of specialised engineering software and in the modification and control of 3D model geometry.

Course-related learning outcomes

Knowledge:
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.
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:
be able to plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions.

Social competences:
Is able to set priorities for implementation specified by the tasks themselves or others.
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:

Assessment of individual work related to the operation of specialized software and procedures of advanced three-dimensional modeling.
Practical tests of the tasks set for the student regarding advanced 3D modeling and integration of control elements of modeled geometry in the context of mechanical and biomedical engineering.
Report on the implementation of tasks assigned to the student in the laboratory.
Final credit in the acquired knowledge and practical modeling skills with the use of advanced CAD tools (the form of a practical test and / or execution of a design task). Passing threshold: 50% of points

Programme content

Discussion of basic concepts and definitions in the field of advanced tools of 3D modelling systems.
Practical application of advanced functions of selected tools and CAD programs with particular emphasis on modelling biomimetic structures of complex geometry and other technical/biomedical objects with organic shapes.
Practical use of advanced tools of Rhinoceros 3D, Catia and Blender software for surface modelling with simultaneous use of all elements of 3D geometry creation (solids, surfaces, curves). Familiarising students with advanced operations for creating 3D surfaces based on a network of curves, deformable plane, drawing along a path along two curve "rails" while maintaining continuity of edges; transformation tools such as twisting, bending a 3D model, flow along a curve, developing expandable surfaces. In addition, the use of tools to control the geometry of the 3D model using a skeleton control element system. Design and modelling of complex geometry objects with organic shapes.

Course topics

none

Teaching methods

1. Lecture with multimedia presentation.
2. Laboratory exercises: presentation of advanced methods and tools used in selected CAD systems, practical application of selected advanced techniques and execution of tasks given by the teacher, implementation of an individual 3D model with complex geometry.

Bibliography

Basic:
1. Przemysław Kiciak, Podstawy modelowania krzywych i powierzchni - Zastosowania w grafice komputerowej, Wydawnictwo Naukowe PWN, 2019
2. Winkler T.: Komputerowo wspomagane projektowanie systemów antropotechnicznych, WNT Warszawa 2005
3. Akihiro Miyauchi, Masatsugu Shimomura, Industrial Biomimetics, Jenny Stanford Publishing, 2019, ISBN 9780429058837
4. Eddie Y K Ng, Yuehao Luo, Bio-Inspired Surfaces and Applications, World Scientific, 2016, ISBN: 978-981-4704-49-6

Additional:
1. Chlebus. E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000
2. André Kutscherauer: 3D Car Modeling with Rhinoceros, 2011
3. Skarka, Wojciech: CATIA V5. Podstawy budowy modeli autogenerujących, Gliwice, Helion, 2008
4. Wełyczko, Andrzej: CATIA V5. Sztuka modelowania powierzchniowego, Gliwice, Helion, 2008
5. 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