



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modelling of bionic and organic structures

Course

Field of study

Biomedical engineering

Area of study (specialization)

Bionics and virtual engineering

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

Polish

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

Lecturers

Responsible for the course/lecturer:

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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.

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.

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. Wętyczko, 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	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for classes, preparation for colloquiums / tests checking knowledge, execution of tasks, preparation of a report on completed tasks, active participation in classes, watching instructional / review films ¹)	20	1,0

¹ delete or add other activities as appropriate