COURSE DESCRIPTION CARD - SYLLABUS

Course name
Virtual modeling and simulations with the basics of CFD

Course

Field of study
Biomedical Engineering
Area of study (specialization)
-
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/6
Profile of study
general academic
Course offered in
Polish
Requirements
elective

Number of hours

Lecture
15
Laboratory classes
30
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points
3

Lecturers

Responsible for the course/lecturer:
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Institute of Applied Mechanics
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Responsible for the course/lecturer:
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Institute of Applied Mechanics
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Prerequisites

KNOWLEDGE: the student has basic knowledge of the methods of computer-aided engineering works, computer recording of structures, has basic knowledge of the strength of materials.

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

SOCIAL COMPETENCES: the student is able to interact and work in a group.

Course objective

Acquiring knowledge in the field of methods and processes related to computer modeling and simulation, in the field of solids and fluid mechanics in the context of biomedical engineering issues.. Acquiring practical knowledge and skills to use specialized CAx engineering software, including computational fluid dynamics (CFD) software.

Course-related learning outcomes

Knowledge

K_W05 - Has a basic knowledge of engineering design and engineering graphics, allowing to apply engineering calculations in biomedical issues, select and evaluate solution variants; apply modeling, optimization and computer-aided design process in the design of biomedical devices.

K_W20 - Has a basic knowledge of the development trends of computer-aided engineering design in the field of biomedical engineering, thanks to which he can use the finite element method (FEM), selected numerical optimization methods, the use of FEM in computer-aided design.

Skills

K_U01 - Can obtain information from literature, databases and other properly selected sources (also in English or another foreign language recognized as the language of international communication) from biomedical engineering and combine them with technical issues and engineering design, can integrate the obtained information, make it interpretation, as well as draw conclusions and formulate and justify opinions.

K_U08 - Can plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions. He can use computer aided to solve technical tasks related to the issues of biomedical engineering and can interpret test results and evaluate measurement errors.

Social competences

K_K01 - Understands the need for lifelong learning; can inspire and organize the learning process of other people.

K_K04 - Can properly define priorities for the implementation of a task set by himself or others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Oral and written tests. Assessment of individually made tasks.

Programme content

The subject is a general introduction to modeling and computer simulation in issues of biomedical engineering.

The student learns about selected issues related to computer static and dynamic analysis, computer analysis of natural vibrations, stability analysis and the basics of computer fluid mechanics. Has the ability to use morphing and biomimetic solutions in engineering structures. Theoretical issues are illustrated with solutions using specific modeling and numerical computation systems.

Laboratory lectures conducted aspects of design and analysis of designed mechanical objects for biomedical applications. They include carrying out numerical experiments with the use of software to support the work of an engineer such as SolidWorks, SolidWorks Simulation, SolidWorks Flow Simulation, Catia v5, Blender, in particular in the scope of the modules: 3D modeling, static analysis and assessment of flow parameters of the designed structure, in particular in the area of biomedical engineering.

Teaching methods

Lectures: presentation of the so-called Case study, multimedia presentation.
Laboratory: presentation and realization of tasks by the student tasks entrusted to him.
Report on the implementation of laboratory tasks assigned to the student.

Bibliography

Basic

John Willis, Sandeep Dogra," SOLIDWORKS Simulation 2019: A Power Guide for Beginners and Intermediate Users", CADArtifex, 2019. ISBN: 1798925478

Matsson John E., "An Introduction to SOLIDWORKS Flow Simulation 2017", 2017

G. Kazimierczak, B. Pacula, A. Budzyński: Solid Edge. Komputerowe wspomaganie projektowania, Wydawnictwo Helion 2004, ISBN: 83-7361-174-6

M. Kleiber: Komputerowe Metody Mechaniki Ciał Stałych, PWN 1995, ISBN 83-01-11740-0

Tkacz E., Borys P., "Bionika", WNT, Warszawa, 2006

Additional

Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work literature studies, preparation for laboratory classes, preparation for credit, execution of tasks and simulations, preparation of reports on performed tasks) [1]	30	1,0

1 delete or add other activities as appropriate