UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

Faculty of Technical Sciences

Course title: IT Science and Technology Environment in Mechatronics

ECTS credit allocation (and other scores): 2

Semester: autumn

Level of study: ISCED-7 - second-cycle programmes (EQF-7)

Branch of science: Engineering and technology

Language: English

Number of hours per semester: 20 lab / 10 lectures

Course coordinator/ Department and e-mail: Bartosz Pszczółkowski, Department of Materials and Machines Technology, bartosz.pszczolkowski@uwm.edu.pl

Type of classes: classes and lectures

Substantive content

CLASSES: Application of CAD/CAM/CAE systems in mechatronic engineering. Mathematical modelling and simulation of mechatronic systems using MATLAB and Simulink. Analysis of electromechanical systems and manufacturing processes. Preparation and verification of technological processes for CNC machines. Design and optimisation of selected mechanical and mechatronic systems using engineering software. Interpretation and analysis of simulation results. Application of computational methods for predicting system behaviour and supporting engineering decision-making. Introduction to artificial intelligence methods and machine learning algorithms used in the design, operation, and optimisation of mechatronic systems. Practical use of modern engineering software for solving complex engineering problems.

LECTURES: Introduction to computational environments used in mechatronics. The role of information technologies in the design, analysis, simulation, and control of mechatronic systems. Fundamentals of computer-aided design, manufacturing, and engineering (CAD/CAM/CAE). Engineering software used for the development and operation of mechatronic devices. Mathematical modelling and computer simulation of mechanical and electromechanical systems. Analysis of manufacturing processes and CNC machine operation. Modern optimisation methods in engineering applications. Applications of artificial intelligence and machine learning in mechatronic systems. Current trends in digital engineering, intelligent manufacturing, and Industry 4.0 technologies.

Learning purpose: To familiarise students with advanced computational environments and engineering software used in the design, analysis, simulation, and control of mechatronic systems. The course aims to develop practical skills in the application of CAD/CAM/CAE systems, MATLAB environments, data analysis, mathematical modelling, and computer simulation. Students will also gain knowledge of modern optimisation methods and the use of artificial intelligence tools in solving engineering problems related to mechatronic systems and manufacturing processes.

On completion of the study programme, the graduate will gain:

Knowledge: Knowledge and understanding of advanced computational environments and engineering software used in mechatronics, including CAD/CAM/CAE systems, mathematical modelling, computer simulation, optimisation methods, and modern approaches to the design and operation of mechatronic systems.

Skills: Ability to use specialised engineering software for modelling, simulation, analysis, and optimisation of mechatronic systems. Ability to prepare and verify selected technological processes, analyse system performance, interpret simulation results, and apply modern computational tools to solve engineering problems.

Social Competencies: Readiness to critically evaluate technical information and continuously develop professional competencies in the fields of mechatronics and information technologies. Ability to work effectively in interdisciplinary teams and responsibly apply modern engineering tools in accordance with professional and ethical standards.

Basic literature:

1. Holly Moore, *MATLAB for Engineers*, Pearson Education, 2021.
2. Stephen J. Chapman, *MATLAB Programming for Engineers*, Cengage Learning, 2019.
3. Ibrahim Zeid, *Mastering CAD/CAM*, McGraw-Hill Education, 2021.
4. Robert H. Bishop (Ed.), *The Mechatronics Handbook*, CRC Press, 2018.
5. Devdas Shetty, Richard Kolk, *Mechatronics System Design*, Cengage Learning, 2019.
6. MathWorks Documentation and Tutorials, MATLAB & Simulink, MathWorks Inc.

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Supplementary literature: Kalpakjian S., Schmid S.R., *Manufacturing Engineering and Technology*, Pearson, 2021.

The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 30

Student's independent work: 16