POZNAN UNIVERSITY OF TECHNOLOGY
EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)
pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name

Computer methods of designing and controlling mechatronic systems

Course

Field of study	Year/Semester
Electrotechnics	3/6
Area of study (specialization)	Profile of study
Energy conversion systems and control systems in mechatronics	general academic
Level of study	Course offered in
First-cycle studies	polish
Form of study	Requirements
full-time	elective

Number of hours

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

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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Prerequisites

Basic knowledge of the theory of electrical circuits, control, computer science, electrical engineering, electronics and power electronics, electrical machines and numerical methods. Knowledge of the structure and operation principles of mechatronics electrical devices and systems.

The ability to effectively self-study in a field related to the chosen field of study, make the right decisions when solving simple tasks and formulate problems in the field of widely understood electrical engineering.

The student is aware of the need to expand their competences, readiness to cooperate as part of a team, the ability to comply with the rules in force during lecture and laboratory classes.

Course objective

Acquiring the ability to create peripheral models of selected mechatronic systems. Acquiring the skill of numerical solving of coupled equations of electrical circuits and equations of mechanical equilibrium. Understanding the computational capabilities of selected commercial programs. Acquiring the skills to use selected simulation tools for electronic and power electronics. Familiarization with the principles of declaring types and parameters of selected analyzes. Acquiring skills to model analog and digital systems, power electronics converters and machine systems. Choosing the optimal numerical method. Errors of selected numerical methods

Course-related learning outcomes

Knowledge

The student has expanded and in-depth knowledge of algebra and mathematical analysis, probability and differential and integral calculus, necessary to describe and analyze the operation of electrical components and systems and the basic phenomena occurring in them.

The student has ordered and theoretically founded general knowledge of numerical methods, enabling solving engineering tasks in the field of electrical engineering, knows IT tools for analyzing and designing selected technical systems.

The student knows the structure and operation of electronic, optoelectronic and simple analog and digital electronic and power electronic devices, understands the processes that occur in their life cycle.

Skills

Student is able to plan and carry out simulation and measurements of basic quantities characteristic of electrical systems; can present the results obtained in numerical and graphic form, interpret them and draw the right conclusions.

The student is able to use known mathematical models and computer simulations to analyze and evaluate the functioning of electrical components and systems

The student is able to use properly selected IT tools to carry out simulation, design and analysis of electrical systems.

Social competences

Understands the importance of knowledge in solving problems and raising professional, personal and social competences; is aware that in technology knowledge and skills quickly become outdated.

Is able to think and act in an entrepreneurial manner in the field of electrical engineering.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

• Credit based on a test consisting of general and test questions. Rating scale 0-51% points - 2.0, 51-61% points - 3.0, 61-71% points - 3.5, 71-81% points - 4.0, 81-91% points - 4.5, 91-100% of points - 5.0.

Laboratory and design exercises:

• test and rewarding of knowledge necessary to implement the problems posed in a given area of laboratory tasks,

• assessment in class - rewarding the increase in the ability to use known principles and methods,

• assessment of knowledge and skills related to the implementation of the exercise task, evaluation of the report of the exercise.

Getting extra points for activity during classes, especially for:

• proposing to discuss additional aspects of the issue,

• effectiveness of applying the acquired knowledge when solving a given problem,

• ability to work as part of a team that practically performs a specific task in a laboratory,

• comments related to the improvement of the teaching process,

• aesthetic care of prepared reports and tasks - as part of self-study.

Programme content

Classification of mechatronic transducer models. Peripheral, field, peripheral-field models. General description of peripheral models. Mathematical models of electromechanical transducers and complex mechatronic systems. Methods for solving state equations. Differential forms of notation of eyelet and nodal equations for electrical circuits. Methods for solving nonlinear differential equations. Algorithm for simulating the operating states of electromechanical transducers with two degrees of freedom.

Characteristics of selected simulation tools and the capabilities of their modules. Selection of analyzes and declaration of their parameters. Choosing a numerical method to minimize calculation errors. Modeling principles for analog and digital (combinational and sequential) systems. Possibilities of cooperation of simulation tools with external processor systems. The concept of real-time simulation. Methods of modeling systems in order to possibly reflect the phenomena occurring in real systems.

Laboratory: building simulation models of selected systems using various simulation tools, verification of results obtained for various numerical methods, performing time and frequency analyzes of modeled systems, optimization analyzes as tools supporting system design, simulation testing for the stability of closed control systems, a simple model implemented in real time.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.

2. Laboratory and design exercises: multimedia presentation, illustrated with examples given on the board, and implementation of tasks given by the teacher - practical exercises. Construction of simulation models and their testing using selected software tools, modeling systems in real time using a selected processor platform.

Bibliography

Basic

1. B. Mrozek, Z. Mrozek, MATLAB i Simulink, W Helion, Gliwice, 2004.

2. R. Burden, J.D. Faires, Numerical Analysis, PWS Publishers, Prindle, Weber&Schmidt, 1985.

3. P. Krauze, Analysis of Electric Machinery, McGraw Hill Book Company, New York 1986.

4. M. Sobierajski, M. Łabuzek, Programowanie w Matlabie dla elektryków, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2005.

5. Artur Król, Joanna Moczko: PSPICE symulacja i optymalizacja układów elektronicznych, WN, Poznań 2000

6. Wiesława Regel: Wykresy i obiekty graficzne w MATLAB. Wyd.MIKOM 2013

7. W. Tłaczała: Środowisko LabVIEW w eksperymencie wspomaganym komputerowo, Wydawnictwo WNT, 2017.

Additional

1. B. Baron, Metody Numeryczne w Turbo Pascalu, HELION, Gliwice 1995.

2. Dokumentacje techniczne wykorzystywanych narzędzi symulacyjnych.

3. Dokumentacje wybranych systemów procesorowych

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes, preparation for passing, preparation of a report - reports on the implemented laboratory exercise, implementation of project tasks)[1]	40	2,0

[1] delete or add other activities as appropriate