

DESCRIPTION OF THE COURSES

- Course code: ARR3228
- Course title: **PROGRAMMING IN MATLAB**
- Language of the lecturer:

<i>Course form</i>	<i>Lecture</i>	<i>Classes</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Number of hours/week*</i>	<i>1</i>		<i>2</i>		
<i>Number of hours/semestr*</i>	<i>15</i>		<i>30</i>		
<i>Form of the course completion</i>	<i>credit</i>		<i>credit</i>		
<i>ECTS credits</i>	<i>2</i>		<i>2</i>		
<i>Total Student's Workload</i>	<i>30</i>		<i>60</i>		

- Level of the course (basic/advanced): basic
- Prerequisites: Programming in C
- Name, first name and degree of the lecturer: Czesław T. Kowalski, dr hab. inż.
- Names, first names and degrees of the team's members: dr inż. Krzysztof Szabat, mgr inż. Mateusz Dybkowski, mgr inż. Jacek Lis
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- Year:.....2..... Semester:.....3.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course): programming in Matlab environment
- Form of the teaching (traditional/e-learning): traditional
- Course description: Programming rules in MATLAB: description of programming language, basics of programming, functions, data types, structural instructions. Calculation of arithmetic and algebraic equations, matrix and vector calculations, complex numbers. Solving of differential equations using MATLAB. Numerical differentiation and integration. Processing off measurement data using MATLAB. Basics of modeling of closed loop systems using SIMULINK (modeling of electrical and electromechanical circuits). Application of MATLAB-SIMULINK for computer aided design of control systems and DSP based systems
- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
1. Introduction to MATLAB, basic instructions in MATLAB window, calculation of arithmetic and algebraic equations, functions, data types, structural instructions.	<i>2</i>
2. Developing of user functions, graphics, matrix and vector calculations, complex numbers, structural instructions.	<i>2</i>
3. Control systems analysis and synthesis using MATLAB (transfer functions, step and impulse answers, system stability, frequency characteristics, controllability and observability, transients in dynamical systems)	<i>2</i>
4. Solving of differential equations using MATLAB. Numerical differentiation and integration. Processing off measurement data using MATLAB.	<i>3</i>
5. Application of SIMULINK to modeling of simple electrical circuits and mechatronic systems.	<i>2</i>
6. Application of SIMULINK to design of closed loop systems (modeling of electrical and electromechanical circuits).	<i>2</i>

7. Application of MATLAB-SIMULINK for computer aided design of control systems and DSP based systems.	2
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- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:
 1. Introduction to MATLAB – basic instructions and programming rules.
 2. Graphics programming in MATLAB.
 3. Matrix calculus – basic matrix and vector operations.
 4. Solving of linear equation sets.
 5. Solving of interpolation and approximation tasks.
 6. MATLAB application for solving of differential equation sets.
 7. Numerical differentiation and integration in MATLAB.
 8. MATLAB application for analysis and synthesis of linear systems in time and frequency domain.
 9. Introduction to SIMULINK. Different transient's generation. Drawing of dynamical systems' answers to different reference signals.
 10. Testing of dynamical properties of linear controllers P, PI, PID. Chosen criteria of adjustment of controller parameters, influence to transient answer of the system with controller to different reference signals.
 11. Modeling of simple linear control systems.
 12. Modeling of nonlinear control systems.
 13. Modeling of DC motor based on differential equations and transfer function.
 14. Dynamical analysis of the DC motor speed control system.

- Project – the contents:

- Basic literature:

1. Mrozek B., Mrozek Z., *MATLAB uniwersalne środowisko do obliczeń naukowo-technicznych*, Wydawnictwo PLJ, Warszawa 1998
2. Zalewski A., Cegiela R., *MATLAB - obliczenia numeryczne i ich zastosowanie*, Nakom, Poznań, 1996
3. Brzózka J., Dorobczyński L., *Programowanie w MATLAB*, MIKOM, Warszawa, 1998

- Additional literature:

1. Saadat H., *Computational aids in control systems using Matlab*, McGraw-Hill, Inc., New York 1993,
2. Ogata K., *Solving Control Engineering Problems with MATLAB*, PRENTICE HALL, New Jersey 1993

- Conditions of the course acceptance/creditation: Lecture – credit, laboratory - credit

* - depending on a system of studies