Załącznik nr 2 do Zarządzenia Nr 915 z 2019 r. Rektora PB

COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Electrical and Electronics Engineering</td><td>Degree level and programme type</td><td>Master's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td>Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Control Theory</td><td>Course code</td><td>IS-FEE-20013W</td></tr>
<tr><td>Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>winter</td></tr>
<tr><td>30</td><td>30</td><td></td><td>15</td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">Acquainting with control plants models (continuous and discrete-time) in the state space, design of regulators and state observers. Developing the ability to use simulation software for the analysis and synthesis of control systems in the state space.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Model of the control plant in the state space: transfer function and state space models, continuous models and discrete models, solution of the state equation, canonical forms, transformation of state space model to its canonical forms, controllability and observability, stability. Pole placement method. State controller, state observer. Optimal control methods: LQR linear-quadratic regulator, Kalman filter (observer), LQG control system.
Classes: State space and transfer function models - transformations; canonical forms; controllability and observability; calculation of the state regulator; calculation of the state observer.
Project: Simulation study of selected automation plants, design and testing of the PID control system, design of the state controller, design of the state observer, simulation tests of the LQG control system.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Informative-problem lecture; Classes; Project classes;</td></tr>
<tr><td>Assessment method</td><td colspan="9">Exam, tests, evaluation of project completion, current progress in project completion, discussion and activity during the classes</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="8">Learning outcomes
After completing this course student</td><td>Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="8">knows and understands the concept of the state space model</td><td></td></tr>
<tr><td>LO2</td><td colspan="8">knows and understands the method of poles placement in the design of the state controller and state observer</td><td></td></tr>
<tr><td>LO3</td><td colspan="8">knows selected methods of optimal control</td><td></td></tr>
<tr><td>LO4</td><td colspan="8">can use the method of poles placement to determine the controller and the state observer</td><td></td></tr>
<tr><td>LO5</td><td colspan="8">can design the optimal LQG control system</td><td></td></tr>
<tr><td>LO6</td><td colspan="8">can use the MATLAB / Simulink software to determine canonical forms, PID controller gains, the state controller and the llinear-gaussian controller, the state observer and Kalman filter</td><td></td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="8">Methods of assessing the learning outcomes</td><td>Type of tuition during which the outcome is assessed</td></tr>
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LO1	Lecture: exam;	
LO2	Lecture: exam;	
LO3	Lecture: exam;	
LO4	Classes: two tests; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	
LO5	Classes: two tests; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	
LO6	Classes: two tests; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	
Student workload (in hours)		**No. of hours**
Calculation	Lecture attendance	30
	Classes attendance	30
	Project attendance	15
	Preparation for the lecture exam; participation in the exam	19
	Preparation for classes	11
	Preparation for classes completion	6
	Preparation for project classes	21
	Working on projects (including preparation of presentations)	6
	Preparation for projects completion	7
	Participation in teacher-student sessions related to the module subject	5
	TOTAL:	**150**

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**82**	**3**
Student workload – practical activities	**101**	**4**

Basic references	1. Dorf R. C., Bishop R. H., Modern control systems. 10th Edition. Prentice Hall 2005. 2. Tewari A., Modern control design: with MATLAB and Simulink. Wiley-IEEE Press 2001 3. Ogata K., Modern control engineering. 4th Edition. Pearson Education International 2002.	
Supplementary references	1. Bequette B. W., Process control, modeling, design and simulation. Prentice Hall 2003. 2. The MathWorks. Control system toolbox user's guide.	
Organisational unit conducting the course	**Department of Automatic Control and Electronics**	**Date of issuing the programme**
Author of the programme	**Zbigniew Kulesza, PhD., DSc.**	**2020-02-20**

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar