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 Engineering</td><td>Degree level and programme type</td><td>Masters 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">Non-linear and Advanced Control of Electromechanical Systems</td><td>Course code</td><td>IS-FEE-20002W</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></td><td>15</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>4</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">The aim of the subject is to develop the theoretical and practical student's knowledge on nonlinear control methods and adaptive techniques used in electromechanical systems. The acquiring experience by students in design of estimation systems of physical quantities and parameters of the electromechanical subsystem. Acquainting students with the methods for stability analysis of nonlinear electromechanical systems. The acquiring experience by students in the experimental investigations of the nonlinear and the adaptive electromechanical system.</td></tr>
<tr><td>Course content</td><td colspan="9">Overview of nonlinearly and adaptively controlled electromechanical systems. Non-linear controllers for time-minimal and without overshoot control of the electromechanical subsystems with DC motors and Permanent Magnets Sychronous Motors. Off-line and on-line estimation techniques of the parameters and the physical quantities of the electrical machines. Vector control methods. Space vector modulation techniques of transistor converters. Dynamic programming method. The analysis of stability of the nonlinearly controlled systems. Digital control methods of electromechanical systems. Experimental exercises with electromechanical systems nonlinearly controlled by Digital Signal Processors. Experimental exercises of the adaptive on-line estimation techniques.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture,laboratory classes</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture – oral exam,
laboratory classes – evaluation of reports and discussion</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="8">Learning outcomes</td><td>Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="8">analyse structure of a simple nonlinear, adaptive electromechanical system</td><td></td></tr>
<tr><td>LO2</td><td colspan="8">designes the adaptive estimator of the parameters and the physical quantity</td><td></td></tr>
<tr><td>LO3</td><td colspan="8">analyses stability of nonlinear system</td><td></td></tr>
<tr><td>LO4</td><td colspan="8">uses adaptive systems with digital signal processor</td><td></td></tr>
<tr><td>LO5</td><td colspan="8"></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>
<tr><td>LO1</td><td colspan="8">exam on lecture content</td><td>L</td></tr>
</table>

LO2	evaluating the student's reports and performance in classes	**LC**
LO3	evaluating the student's reports and performance in classes	**LC**
LO4	evaluating the student's reports and performance in classes	**LC**
LO5		

Student workload (in hours)		**No. of hours**
Calculation	**lecture attendance**	**30**
	participation in laboratory classes	**15**
	preparation for lecture, laboratory classes	**15**
	work on reports	**25**
	preparation for and participation in exam	**15**
	TOTAL:	**100**

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**45**	**1,5**
Student workload – practical activities	**70**	**2,5**

Basic references	1. Krause P., Wasynczuk O., Sudhoff S.: Analysis of Electric Machinery and Drive Systems", Willey-Interscience, USA, 2002. 2. Boldea I. Nasar S.A. "Electric Drives", 2nd Edition, Taylor and Francis Group, Boca Raton, 2006. 3. Bin Wu, Yonpqiang Lang, Navid Zargari, Samir Kouro: „Power Conversion and control of wind energy systems", IEEE Press, A John Willey and sons, INC, Publication, Canada, 2011 4. Veltman Andre, Pulle Duco W.J., Doncker R, W, D.: „Fundamental of Electrical Drives", Springer, Netherlands, 2007
Supplementary references	1. Seung-Ki Sul: „Control of Electric Machine Drive Systems", IEEE Press, A John Willey and sons, INC, Publication, USA, 2011. 2. Leonard W. "Control of Elektric Drives", 3rd Edition, Springer-Verlag, Berlin, 2001, 3. Alahakoon Sanath: „Digital Control Techniques for Sensorless Electrical Drives", VDM Verlar Dr Muller, Germany, 2009. 4. Wilamowski B. M., Irwin J.D. „ Control and Mechatronics", Taylor $ Francis, USA, 2011 5. Vukosavic S. N.: „Digital Control of Electric Drives, Sringer, 2007

Organisational unit conducting the course	**Department of Electrotechnics, Power Electronics and Power Engineering**	**Date of issuing the programme**
Author of the programme	**Andrzej Andrzejewski, PhD Eng**	**14.02.2020**

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