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 colspan="2">Degree level and programme type</td><td>bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Control Engineering and Systems</td><td colspan="2">Course code</td><td>IS-FEE-10024S</td></tr>
<tr><td colspan="2">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>summer</td></tr>
<tr><td>30</td><td></td><td></td><td></td><td>30</td><td></td><td></td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Fundamentals of Control Engineering</td></tr>
<tr><td>Course objectives</td><td colspan="9">This course extends the students' knowledge of state space approach to analyze and synthesis of control systems. Workshops will learn how to design and simulate considered systems in specialized software.</td></tr>
<tr><td>Course content</td><td colspan="9">Description of multivariable dynamical systems in state space and by the use of transfer matrix. Controlability and observability of linear systems, Kalman decomposition. Modal control, observer synthesis, use of observer to modal control. Linear matrix inequalities. Computer aided design and simulations of control systems.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, specialized workshops</td></tr>
<tr><td>Assessment method</td><td colspan="9">written exam (lecture), evaluation of reports (workshops)</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="7">Learning outcomes</td><td colspan="2">Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="7">express a dynamical system in state-space form</td><td colspan="2"></td></tr>
<tr><td>LO2</td><td colspan="7">classify models of multivariable dynamical systems</td><td colspan="2"></td></tr>
<tr><td>LO3</td><td colspan="7">desribe procedure of synthesis of modal control and state observer</td><td colspan="2"></td></tr>
<tr><td>LO4</td><td colspan="7">use an observer to estimate a state of dynamical system</td><td colspan="2"></td></tr>
<tr><td>LO5</td><td colspan="7">use specialized software to design and analyze of control systems</td><td colspan="2"></td></tr>
<tr><td>LO6</td><td colspan="7"></td><td colspan="2"></td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="7">Methods of assessing the learning outcomes</td><td colspan="2">Type of tuition during which the outcome is assessed</td></tr>
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LO1	exam, evaluation of reports	L, SW
LO2	tests on lecture content	L
LO3	tests on lecture content	L
LO4	exam, evaluation of reports	L, SW
LO5	evaluation of reports	SW
LO6		

Student workload (in hours)		No. of hours
Calculation	lecture attendance	30
	individual work on lecture topics	30
	preparation for and participation in exam	45
	participation in workshops	30
	work on reports	30
	TOTAL:	165

Quantitative indicators	HOURS	No. of ECTS credits
Student workload – activities that require direct teacher participation	60	2
Student workload – practical activities	105	4

Basic references	1. Norman N. S.: Control systems engineering 5th ed., John Wiley a. Sons, Hoboken 2008. 2. Friedland B.: Control System Design: An Introduction to State-Space Methods, Dover Publ. Inc. 2005. 3. Williams II R. L., Lawrence D. A.: Linear State-Space Control Systems, John Wiley a. Sons, New Jersey 2007. 4. Kaczorek T.: Linear Control Systems, vol. 1 and 2, Research Studies Press, 1993. 5. Doyle J.C., Francis B.A., Tannenbaum A.R.: Feedback Control Theory, Macmillan, 1992.
Supplementary references	1. Kaczorek T.: Polynomial and Rational Matrices: Applications in Dynamical Systems Theory , Springer-Verlag, 2006. 2. Rogowski K.: Presentations for lecture (on-line available).

Organisational unit conducting the course	Control Engineering and Electronics	Date of issuing the programme
Author of the programme	Krzysztof Rogowski	31.03.2016

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