COURSE DESCRIPTION CARD – SPECIMEN

<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>bachelor's degree, full time programme</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 of Electrical Drives 2</td><td>Course code</td><td>IS-FEE-10084S</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>summer</td></tr>
<tr><td>15</td><td>-</td><td>30</td><td></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">Brushless DC motor drives and stepping motor drives. The structure and the features of the Field Oriented Control of electrical drives with permanent magnets synchronous motor and asynchronous motor. Acquiring experience by students in the configuration, maintenance and operation of automatically controlled electrical drives.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture: Control of DC motors in the field-weakening region. Scalar and Field Oriented Control (FOC) of AC of induction motors/generators. Park and Clarke transformations. The vector control of synchronous motors/generators supplied by power converter. The mathematical models of electrical motors and of DC and AC power converters. Servo drive systems. Control methods of stepping motor. Examples of the use of microprocessor control systems in electric drives. Current, speed and position sensors (current transducers, encoders, resolvers, etc.).
Laboratory classes: Experimental exercises with automatically controlled electrical drives. Investigation into four quadrant electrical and mechanical energy conversion in electric drive with DTC-SVM, induction motor and induction generator. Investigation into position control system containing Field Oriented Control of induction motor. Investigation into speed control system of DC motor in field weakening region. Investigation into speed control system of Brushless DC Motor (BLDCM). Investigation into Field Oriented Control (FOC) of Permanent Magnets Synchronous Motor (PMSM).</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, laboratory experiments, demonstration, problem-based learning, small group teaching, work on a project</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture, laboratory experiments, demonstration, problem-based learning, small group teaching</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></td><td colspan="7">Knowledge: the graduate knows and understands</td><td colspan="2"></td></tr>
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LO1	the structure of a simple servo drive	
	Skills: the graduate is able to	
LO2	conduct basic research of current, speed and position control subsystems	
LO3	perform basic configuration and operation of automatically controlled drives	
LO4	interpret the results from basic laboratory investigation of electrical drives	
LO5		
LO6		
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	oral tests on lecture content	L
LO2	assessment of the drive operation, evaluating the student's reports	LC
LO3	assessment of the drive operation, evaluating the student's reports	LC
LO4	assessment of the drive operation, evaluating the student's reports	LC
LO5		
LO6		
Student workload (in hours)		**No. of hours**
Calculation	lecture attendance	15h
	participation in laboratory classes	30h
	participation in student-teacher sessions	5
	preparation for laboratory classes	40h
	work on laboratory classes reports	45h
	preparation for tests	15h
	TOTAL:	150h

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	50h	2
Student workload – practical activities	120h	5

Basic references	1. Weidauer Jens: "Electrical drives: principles, planning, applications, solutions", Erlangen: Publicis Publishing, 2014. 2. Mohan N.: "Advanced electric drives: analysis, control and modeling using MATLAB/Simulink", Hoboken: John Willey and sons, 2014. 3. Seung-Ki Sul: "Control of Electric Machine Drive Systems", IEEE Press, A John Willey and sons, INC, Publication, USA, 2011. 4. Weidauer J. "Electrical drives : principles, planning, applications, solutions." Erlangen: Publicis Publishing, 2014. 5. Wilamowski B. M., Irwin J.D. "Control and Mechatronics", Taylor and Francis, USA, 2011.
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. Chang Y. "Crucial problems of powertrain control in electric vehicles and hybrid electric vehicles", Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2019.	
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.	02.02.2023

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