

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Automatyka napędu elektrycznego-podstawy**  
 Name in English: **Controlled Electrical Drives - fundamentals**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, part-time**  
 Kind of subject: **optional**  
 Subject code: **ELR053266**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	20				
Number of hours of total student workload (CNPS):	120				
Form of crediting:	examination				
For group of courses mark (X) final course:					
Number of ECTS points:	4				
including number of ECTS points for practical (P) classes:					
including number of ECTS points for direct teacher-student contact (BK) classes:	2.80				

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

- Has a matured knowledge in the field of commonly used electrical machines and basics of the drive systems.
- Has a knowledge on the methods of mathematical description, stability analysis methods and dynamical properties of linear and nonlinear control systems

**SUBJECT OBJECTIVES**

- C1. Familiarizing students with the basic methods and structures of controlled converter-fed DC motor drives and their practical realization.
- C2. Familiarizing students with the basic methods and structures of scalar and vector controlled converter-fed AC motor drives and their practical realization.

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 Has matured knowledge on control methods and basic structures of DC motor.
- PEU\_W02 Has matured knowledge on control methods and basic structures of induction motor drive and brushless DC and AC motors with permanent magnets.
- PEU\_W03 Can define and describe basic control methods and structures for DC motors, induction motors, brushless DC and AC motors, and characterize their performance.

*relating to skills:**relating to social competences:*

- PEU\_K01 Understands the need for continuous life-long learning and qualifications improving (including II and III level university studies)

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction, the main goal of the lecture, credit requirements. Classification of the control structures for electrical drives. Basic torque control structures of electrical motors.	2
Lec 2	Influence of the control mode to the dynamical performance of the DC motor – operation with constant and variable excitation flux.	2
Lec 3	Cascade and parallel speed control structure of the DC motor drive. Controllers' adjustment, dynamical performances obtained in both control structures. Comparison. Part 1.	2
Lec 4	Cascade and parallel speed control structure of the DC motor drive. Controllers' adjustment, dynamical performances obtained in both control structures. Comparison. Part 2.	2
Lec 5	Induction motor – mathematical model using vector representation, state equations, equivalent circuit in vector form.	2
Lec 6	Influence of the control method to the static characteristic of the induction motor. Frequency controlled induction motor drives – torque control methods of the induction motor.	2
Lec 7	Methods and structures of the field-oriented control (FOC) and the direct torque control method (DTC); control idea, practical realization issues.	2
Lec 8	Scalar control methods with constant flux and constant slip frequency.	2
Lec 9	Frequency control methods for permanent magnet synchronous motors. Application of AC motors in servodrives.	2
Lec 10	Trends and developments in controlled electrical driver – sensorless control, intelligent control.	2
Total hours:		<b>20</b>

TEACHING TOOLS USED
N1. Lecture with multimedia tools combined with classical lecture (problem oriented).
N2. Consultations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Participation in the lectures.
F2(w)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Final exam.
P(w)	$P=0,1 \cdot F1 + 0,9 \cdot F2$	

PRIMARY AND SECONDARY LITERATURE
<b>PRIMARY LITERATURE:</b> [1] Kaźmierkowski M.P., Tunia H., Automatyka napędu przekształtnikowego. PWN, 1987 [2] Orłowska-Kowalska T., Bezczytnikowe układy napędowe z silnikami indukcyjnymi. Oficyna Wydawnicza P.Wr., Wrocław, 2003 [3] Zawirski K., Deskur J., Kaczmarek T., Automatyka napędu elektrycznego, Wyd. Polit. Poznańskiej, 2012 [4] Orłowska-Kowalska T., Automatyka napędu elektrycznego - podstawy. Oficyna Wydawnicza P.Wr., Wrocław, w druku <b>SECONDARY LITERATURE:</b> [1] Napęd elektryczny, praca zbiorowa pod red. Z. Grunwalda, WNT, 1987 [2] P.Vas, Sensorless Vector and Direct Torque Control, Oxford University Press, 1998 [3] J.M.D.Murphy, F.G.Turnbull, Power Electronic Control of AC Drives, Pergamon Press, Oxford, 1988 [4] W. Leonhard, Control of Electrical Drives, Springer Verlag, 1990

SUBJECT SUPERVISOR
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