FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Elektromechaniczne systemy napędowe**
Name in English:	**Electromechanical drive systems**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Electrical Power Engineering**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ELR053209**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	90		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	3		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has the general knowledge of fundamental laws of mechanical and electrical engineering. Student has a basic knowledge of the analysis of electrical circuits and the construction and operation of electrical machines.
2. Student has a basic knowledge of the theory of electric drives and the operation of power electronics and control systems.
3. Student has the ability to critically analyze the operation of selected mechanical, electrical and electric drive systems.
4. Student can work in a group and present the results of his work .

SUBJECT OBJECTIVES

C1. Presentation of principles of electromechanical energy conversion and methods of formulation and analysis of mathematical models of electromechanical drive systems.

C2. Understanding of the electromechanical and electromagnetic phenomena in electromechanical drive systems.

C3. Obtaining of the skills for analysis and synthesis of control systems of electromechanical drive systems.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	The student has the knowledge for formulation of mathematical models of electromechanical drive systems and using it for the analysis and simulation of electromechanical drive systems
PEU_W02	The student is able to describe the properties of electromechanical drive systems and knows the methods of shaping of these properties

relating to skills:

PEU_U01	The student has the ability to interprate basic electromagnetic parameters and determine its influence on the characteristics of electromechanical drive systems.
PEU_U02	The student has the ability to determine the properties of electromechanical drive systems on the base of analysis or simulatio and experimental results

relating to social competences:

PEU_K01	The student understands the need of active attitude for development of self-knowledge and skills

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Classification and structures of electromechanical drive systems	2
Lec 2	Physical and mathematical models of mechanical and electrical components of electromechanical drive systems	2
Lec 3	Methods of classical and energetic analysis of electromechanical drive systems	2
Lec 4	Modeling and analysis of the equations of motion, and structural diagrams of the one-mass, two-mass system with a resilient connection and multibody systems	2
Lec 5	State equations and structural schemes of electromechanical drive systems with DC motors	2
Lec 6	Analysis of electromechanical and electromagnetic processes in control electromechanical drive systems with DC motors	2
Lec 7	Modelling of electromechanical drive systems with three-phase induction motors	2
Lec 8	odelling of electromechanical drive systems with polyphase induction motors	2
Lec 9	Analysis of electromechanical and electromagnetic processes in electromechanical drive systems with induction motors	2
Lec 10	Analysis of electromechanical system with induction generator	2
Lec 11	Modeling and analysis of electromechanical drive systems with synchronous motors	2
Lec 12	Modeling and analysis of electromechanical drive systems with BLDCM	2
Lec 13	Modeling and analysis of electromechanical drive systems with PMSM motors	2
Lec 14	Principles and methods of modeling electromechanical drive systems using bond graphs	2
Lec 15	Fundamentals of design and selection of electromechanical drive systems in industrial applications	2
	Total hours:	**30**

Form of classes - laboratory		**Number of hours:**
Lab 1	Presentation of the Laboratory Safety Regulations and Laboratory Procedure Rules. Presentation of the laboratory devices and measuring equipment. Establishing the rules for realization and passing of laboratory exercises.	2
Lab 2	Investigation of electromechanical drive system with DC motor.	2
Lab 3	Investigation of multimotor electromechanical drive system	2
Lab 4	Investigation of electromechanical drive system with induction motor	2
Lab 5	Investigation of multimachine cascade electromechanical drive system with wound induction motor	2
Lab 6	Investigation of selected states of electromechanical energy conversion in electromechanical drive system	2
Lab 7	Investigation of electromechanical drive system with autonomous induction generator	2
Lab 8	Final written test	1
	Total hours:	**15**

TEACHING TOOLS USED
N1. Subject lecture
N2. Lecture with multimedia presentation
N3. Laboratory tests conducted in the traditional manner in student exercise groups

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02	Exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Positive notes from laboratory test reports
F2(L)	PEU_U01 PEU_U02 PEU_K01	Positive note from written test
P(L)	P=0,3*F1 + 0,7*F2	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Jagiełło A.S.: Systemy elektromechaniczne dla elektryków, Politechnika Krakowska, Kraków, 2008
[2] Meisel J.: Zasady elektromechanicznego przetwarzania energii, WNT, Warszawa, 1970.
[3] Puchała A.: Dynamika maszyn i układów elektromechanicznych, PWN, Warszawa, 1977.

SECONDARY LITERATURE:

[1] Czemplik A.: Modele dynamiki układów fizycznych dla inżynierów. Zasady i przykłady konstrukcji modeli dynamicznych obiektów automatyki. WNT, Warszawa, 2008
[2] Paszek W.: Stany nieustalone maszyn elektrycznych prądu przemiennego. WNT, Warszawa, 1986

SUBJECT SUPERVISOR

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