FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Sterowanie przekształtnikami energoelektronicznymi**
Name in English:	**Control of Power Electronic Converters**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	**Renewable Energy Systems**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**optional**
Subject code:	**ELR053227**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		15		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of analysis and synthesis of linear and nonlinear circuits.
2. It has a basic knowledge of the construction and operation electronic systems and power electronics basics
3. It has a basic knowledge of electrical machines and electromechanical drive systems
4. It has a basic knowledge of theory automatic control systems.
5. Able to perform basic measurements of electrical devices using analog and digital oscilloscope.
6. He can verify the results of laboratory measurements with theoretical knowledge.

SUBJECT OBJECTIVES

C1. Familiarize students with the basic control systems and control of power converters.
C2. Familiarize students with basic mathematical models and how to analyze the response of the converter control.
C3. Familiarize students with the basic characteristics of practical power electronic converters control systems.
C4. Acquiring the ability to develop research results, their interpretation and the interpretation and critical evaluation.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	It has an knowledge of the control of power semiconductor devices.
PEU_W02	He knows the basics of control systems and automatic control power electronic converters.
PEU_W03	He knows the basic methods of mathematical description of control systems of power converters.

relating to skills:

PEU_U01	Able to organize test of industrial power electronic systems.
PEU_U02	It can determine the basic characteristics of the power converters working as part of the control system.
PEU_U03	It can present the results in numerical and graphical form and to interpret them. He can draw conclusions from the measurements.

relating to social competences:

PEU_K01	He can think and act in a creative and enterprising.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Optimization of SCR thyristor triggering.	2
Lec 2	SCR thyristor drivers, TRIAC drivers, GTO drivers.	2
Lec 3	Optimization of BJT transistor control.	2
Lec 4	BJT power transistor drivers, MOSFET power transistor drivers, IGBTO transistor drivers.	2
Lec 5	Control systems of controlled rectifiers, AC controllers, cycloconverters.	2
Lec 6	Control systems of DC AC converters.	2
Lec 7	Control systems of DC-DC converters.	2
Lec 8	Course credit.	1
	Total hours:	**15**

Form of classes - laboratory		**Number of hours:**
Lab 1	Introduction. The organization of classes. Conditions of gaining credit.	2
Lab 2	Testing of triggering and phase control systems of thyristor.	2
Lab 3	Testing of control systems of thyristor rectifiers and cycloconverters.	2
Lab 4	Testing of control systems of AC- voltage controllers.	2
Lab 5	Testing of control systems of three phase thyristor inverter.	2
Lab 6	Testing of control systems of three phase transistor PWM inverter.	2
Lab 7	Test of inverter control system of cooperates with the network of alternating current.	2
Lab 8	Course credit.	1
	Total hours:	**15**

TEACHING TOOLS USED

N1. Informative lecture using presentation slides.
N2. Job self, self-preparation of the laboratory.
N3. Consultation.

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 PEU_W03 PEU_K01	
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_U03	Check preparation for classes.
F2(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Activity in the conduct of laboratory measurements.
F3(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Appraisal reports made.
P(L)	P=0,25*F1+0,25*F2+0,5*F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Yuriy Rozanov: Power Electronics Basics: Operating Principles, Design, Formulas, and Applications, ORC, 2015
[2] Branko L. Dokic: Power Electronics: Converters and Regulators, Springer, 2015.
[3] Bogdan M. Wilamowski, J. David Irwin: Power Electronics and Motor Drives (The Industrial Electronics Handbook) CRC Press 2011
[4] A. Trzynadlowski: Introduction to Modern Power Electronics, CRC, 2002

SECONDARY LITERATURE:

[1] Adrian Ioinovici: Power Electronics and Energy Conversion Systems: Fundamentals and Hard-switching Converters, Volume 1, Wiley 2013.
[2] Mukund R. Patel: Introduction to Electrical Power and Power Electronics, CRC Press, 2012
[3] Muhammad Rashid: POWER ELECTRONICS HANDBOOK, ORC, 2010
[4] Euzeli dos Santos: Advanced Power Electronics Converters: PWM Converters Processing AC Voltages (IEEE Press Series on Power Engineering), 2014
[5] Marian P. Kazmierkowski, Ramu Krishnan: Control in Power Electronics: Selected Problems. 2004

SUBJECT SUPERVISOR
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