

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: **ELR043227**  
 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 EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 It has an knowledge of the control of power semiconductor devices.  
 PEK\_W02 He knows the basics of control systems and automatic control power electronic converters.  
 PEK\_W03 He knows the basic methods of mathematical description of control systems of power converters.

*relating to skills:*

- PEK\_U01 Able to organize test of industrial power electronic systems.  
 PEK\_U02 It can determine the basic characteristics of the power converters working as part of the control system.  
 PEK\_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:*

- PEK\_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, IGBT0 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:		<b>15</b>

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:		<b>15</b>

## TEACHING TOOLS USED

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

## EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02 PEK_W03 PEK_K01	
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_U03	Check preparation for classes.
F2(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Activity in the conduct of laboratory measurements.
F3(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Appraisal reports made.
P(L)	$P=0,25 \cdot F1 + 0,25 \cdot F2 + 0,5 \cdot F3$	

## 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. Trzynadłowski: 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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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
ELR043227 - Control of Power Electronic Converters  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**  
AND SPECIALIZATION **Renewable Energy Systems****

<b>Subject educational effect</b>	<b>Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)</b>	<b>Subject objectives</b>	<b>Programme content</b>	<b>Teaching tool number</b>
PEK_W01	S2RES_W18	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3
PEK_W02	S2RES_W18	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3
PEK_W03	S2RES_W18	C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.3
PEK_U01	S2RES_U20	C.3 C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.2 N.3
PEK_U02	S2RES_U20	C.3 C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.2 N.3
PEK_U03	S2RES_U20	C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.2 N.3
PEK_K01	K2ETK_K06	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.1 N.2 N.3