

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Energoelektronika w automatyce przemysłowej**  
 Name in English: **Power electronics in industry automation**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable): **Renewable Energy Sources**  
 Level and form of studies: **2nd level, full-time**  
 Kind of subject: **optional**  
 Subject code: **ELR053221**  
 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:	examination		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 the principles of operation of electronic systems and power electronics.
2. It has a basic knowledge of automatic control systems.
3. It has a basic knowledge of machinery, equipment and electric drives.
4. It can effectively apply knowledge of electrical circuit theory to describe power electronics systems
5. He can perform basic measurements of electrical quantities using analog instruments, digital instruments and an oscilloscope.

**SUBJECT OBJECTIVES**

- C1. Familiarize students with the basic knowledge concerning the specifics of the work of electric power converters in industrial automation systems.
- C2. To acquaint the student with the basic characteristics of the converters cooperating with electrical machines and electrical equipments.
- C3. The acquisition of practical knowledge of construction measurement systems to determine the characteristics of the actual converter systems.

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

- PEU\_W01 It has an elementary knowledge of the use of power converters as power components in systems of automatic control of industrial equipment.
- PEU\_W02 Has an elementary knowledge on how to control the output parameters of power converters.
- PEU\_W03 Knows the basic conditions for co-operation of electrical machinery and electrical equipment with power electronic converters.

*relating to skills:*

- PEU\_U01 He can arrange testing of power electronic systems
- PEU\_U02 He can determine the basic characteristics of power converters operating 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	Controlled rectifier in the automated driving systems DC. Controlled rectifier in systems welding of metals.	2
Lec 2	Controlled Rectifiers in DC transmission grids.	2
Lec 3	AC thyristor controllers in systems soft start AC motors.	2
Lec 4	DC converters in vehicle propulsion systems.	2
Lec 5	Voltage inverters in automated systems AC drives.	2
Lec 6	Resonant inverters in industrial heating systems.	2
Lec 7	The use of inverters as active filters and rectifiers.	2
Lec 8	Mathematical modeling of converters.	1
Total hours:		<b>15</b>

Form of classes - laboratory		Number of hours:
Lab 1	Getting Acquainted with the positions of the laboratory. Principles of measurements.	2
Lab 2	Research single phase cycloconverter.	2
Lab 3	Research single phase AC controller with integration control.	2
Lab 4	Research single- phase inverter with DC circuit with closed-loop control.	2
Lab 5	Research cooperation: three-phase inverter with external power source.	2
Lab 6	Research power supply with high frequency transformer.	2
Lab 7	The test of DC power converter.	2
Lab 8	Crediting with grade.	1
Total hours:		<b>15</b>

### TEACHING TOOLS USED

- N1. Lectures using multimedia techniques.  
 N2. Laboratory test performed on specialized research positions in groups.  
 N3. Consultation.

### 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	Written exam
F2(w)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Oral exam
P(w)	$P=0,4 \cdot F1 + 0,6 \cdot F2$	
F1(L)	PEU_U01 PEU_K01	Evaluation of preparation for laboratory.
F2(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Activity during laboratory classes.
F3(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Evaluation reports conducted laboratory measurements.
P(L)	$P=0,25 \cdot F1 + 0,25 \cdot F2 + 0,5 \cdot F3$	

<b>PRIMARY AND SECONDARY LITERATURE</b>
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<b>PRIMARY LITERATURE:</b>
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| <ul style="list-style-type: none"><li>[1] Tunia H., Winiarski B.: Energoelektronika. Warszawa WNT 1994.</li><li>[2] Kaźmierkowski M.P. ,Matysik J.T.: Wprowadzenie do elektroniki i energoelektroniki. WPW., Warszawa 2005.</li><li>[3] O. Ferenczi: Zasilanie układów elektronicznych. Zasilacze impulsowe, WNT, Warszawa 1989</li><li>[4] Zasilanie układów elektronicznych: Zasilacze ze stabilizatorami o pracy ciągłej. Przetwornice DC-DC. , WNT, Warszawa 1988.</li><li>[4] Borkowski A.: Zasilanie urządzeń elektronicznych, Warszawa, WKiŁ, 1990</li><li>[5] Muhammad Raschid.: Power Electronics Handbook, Third Edition, Butterworth-Heinemann, 2011.</li></ul> |
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<b>SECONDARY LITERATURE:</b>
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| <ul style="list-style-type: none"><li>[1] Barlik R., Nowak M.:Poradnik inżyniera energoelektronika. WNT, Warszawa 2013.</li><li>[2] Strzelecki R., Supronowicz H.: Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa 2000.</li><li>[3] Mikołajuk K.: Podstawy analizy obwodów energoelektronicznych. Warszawa, PWN 1998.</li><li>[4] Branko L. Dokic: Power Electronics: Converters and Regulators, Springer, 2015.</li><li>[5] Adrian Ioinovici: Power Electronics and Energy Conversion Systems: Fundamentals and Hard-switching Converters, Volume 1, Wiley 2013.</li></ul> |
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<b>SUBJECT SUPERVISOR</b>
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