

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Sterowanie pracą przekształtników energoelektronicznych**
 Name in English: **Control of power electronics converters**
 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: **obligatory**
 Subject code: **ELR053220**
 Group of courses: **NO**

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

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 design and operation of of electronic devices and circuits, and basics power electronics.
3. It has a basic knowledge of electrical machines and electromechanical drive systems.
4. It has a basic knowledge of automatic control systems.
5. Can apply knowledge in the field of electrical circuit theory to analyze transients in linear and nonlinear circuits.
6. Can apply knowledge of control theory to the analysis and synthesis of control systems
7. He understands the need for continuing education and professional skills development.

SUBJECT OBJECTIVES

- C1. To acquaint the student with the basic principles of nonlinear control, impulse automatic control systems.
 C2. Familiarize students with the basic mathematical models and method of operation analysis power converters.
 C3. To acquaint the student with the basic applications of power electronic systems used in renewable energy system.

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 He has expertise in the field of power electronics systems working with renewable energy sources.
 PEU_W02 He knows the principle of control and automatic regulation of power electronics converters.
 PEU_W03 He has knowledge of the applications of power electronics in renewable energy.

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

- PEU_K01 He can think and act in a creative way.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Power Semiconductor Devices. Basic gate control.	2
Lec 2	Multi-phase thyristor rectifier. Control of the output voltage.	2
Lec 3	Control the output current rectifiers. Adaptive regulators.	2
Lec 4	Control of DC DC converters.	2
Lec 5	One, two and four quadrant switching converters.	2
Lec 6	Voltage inverter and current inverters.	2
Lec 7	Multilevel inverters.	2
Lec 8	Controls of inverters.	2
Lec 9	Pulse-width-modulated (PWM)	2
Lec 10	Closed loop operation of inverters.	2
Lec 11	Controls of current source inverters.	2
Lec 12	Control of three-phase active rectifier.	2
Lec 13	Control of converters for wind generators with variable speed.	2
Lec 14	Mathematical modeling of power converters.	2
Lec 15	Final test.	2
Total hours:		30

TEACHING TOOLS USED

- N1. Informative lectures using presentation slides.
 N2. Individual work, self-study.
 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 PEU_K01	Written test
F2(w)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Oral test
P(w)	$P=0,4*P1+0,6*P2$	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Tunia H., Winiarski B.: Energoelektronika. Warszawa WNT 1994.
- [2] Januszewski S., Świątek H., Zymmer K.: Półprzewodnikowe przyrządy mocy. Warszawa WKŁ 1999.
- [3] Kaźmierkowski M.P., Matysik J.T.: Wprowadzenie do elektroniki i energoelektroniki. WPW., Warszawa 2005.
- [4] Piróg S.: Energoelektronika. Układy o komutacji sieciowej i twardej. Wydawnictwo AGH. Kraków 2006.
- [5] Muhammad Raschid.: Power Electronics Handbook, Third Edition, Butterworth-Heinemann, 2011.
- [6] Rozanov Y., Ryvkin S., Chaplygin E., Voronin P.: Power Electronics Basics: Operating Principles, Design, Formulas, and Applications, CRC Press 2015.
- [7] Ned Mohan: Power Electronics: A First Course, Wiley 2011

SECONDARY LITERATURE:

- 1] Barlik R., Nowak M.: Poradnik inżyniera energoelektronika. WNT, Warszawa 2013.
- [2] Strzelecki R., Supronowicz H.: Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa 2000.
- [3] Mikołajuk K.: Podstawy analizy obwodów energoelektronicznych. Warszawa, PWN 1998.
- [4] Branko L. Dokic: Power Electronics: Converters and Regulators, Springer, 2015.
- [5] Adrian Ioinovici: Power Electronics and Energy Conversion Systems: Fundamentals and Hard-switching Converters, Volume 1, Wiley 2013.

SUBJECT SUPERVISOR

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