

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Przekształtniki energoelektroniczne w układach zasilania i sterowania 1**
 Name in English: **Power converters in supply and control system 1**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Industrial Electrical Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR053211**
 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):	90				
Form of crediting:	examination				
For group of courses mark (X) final course:					
Number of ECTS points:	3				
including number of ECTS points for practical (P) classes:					
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of the principles of semiconductor devices and power electronic systems.
2. He knows the basic methods of mathematical description of power converter systems and their control systems.
3. Understands and is able to describe the basic physical processes occurring during the conversion of electrical energy by means of static converters.
4. Is able to be used to analyze the mathematical apparatus steady-state and transient in linear and nonlinear electric circuits which contain passive and active element.
5. He can effectively apply the knowledge in the field of automation for analysis of system operation control of power converters.
6. He understands the need for continuing education and professional skills developments.
7. It has a sense of responsibility for their own work.

SUBJECT OBJECTIVES

- C1. Acquaint the student with the topology power converters used in electrical equipment.
 C2. To acquaint the student with the complex mathematical models of static converters used in supply systems.
 C3. Acquisition of practical knowledge necessary for the construction of measuring systems used to study the characteristics of the converters.

SUBJECT LEARNING OUTCOMES*relating to knowledge:*

- PEU_W01 It has a basic knowledge of the principles of operation of power converter in power supply systems AC and DC.
 PEU_W02 He understands the physical principles of electrical energy conversion in complex systems consisting of: the supply network, power converters and load of converters.
 PEU_W03 It has knowledge of the principles of magnetic components used in static converters.

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

- PEU_K01 He understands the need for learning and improvement of qualifications.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	An Introduction. Basic supply DC and AC.	2
Lec 2	Power Supply DC. Linear voltage regulator.	2
Lec 3	Switching power supply DC - DC converters with pulse width modulation. Step-down and Step-up converters.	2
Lec 4	Switching regulators. Single-ended isolated flyback regulators. Single-ended isolated forward regulators.	2
Lec 5	Comparison of power switching supplies.	2
Lec 6	AC supply converters. Basic topologies.	2
Lec 7	AC converters with pulse width modulated.	2
Lec 8	Power supplies input circuits: rectifiers, filters the input. Basis of design and choice of components for converters.	2
Lec 9	The magnetic elements switching power supplies. Filters and Reactors for inverters, transformers for pulse converters.	2
Lec 10	Resonant converters and quasi-resonant used in power systems. Basic topologies.	2
Lec 11	Power factor correction circuits for rectifier.	2
Lec 12	Automatic control of output signals of converters. Basic method of synthesis of closed control systems output parameters of converters.	2
Lec 13	EMI effects of power converters. Basic methods of reducing interference.	2
Lec 14	The main fields of applications of power supplies.	2
Lec 15	Mathematical modeling of converters.	2
Total hours:		30

TEACHING TOOLS USED
N1. Lecture using audio-visual presentation. N2. Individual work, self-study. N3. Consultation.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F - forming (during semester)</i> <i>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 exam.
F2(w)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Oral exam
P(w)	$P=0,4 \cdot F1 + 0,6 \cdot F2$	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Kaźmierkowski M.P., Matysik J.T.: Wprowadzenie do elektroniki i energoelektroniki. WPW., Warszawa 2005. [2] O. Ferenczi: Zasilanie układów elektronicznych. Zasilacze impulsowe, WNT, Warszawa 1989 [3] Zasilanie układów elektronicznych: Zasilacze ze stabilizatorami o pracy ciągłej. Przetwornice DC-DC., WNT, Warszawa 1988. [4] Borkowski A.: Zasilanie urządzeń elektronicznych, Warszawa, WKiŁ, 1990 [5] Muhammad Raschid.: Power Electronics Handbook, Third Edition, Butterworth-Heinemann, 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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