

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Energoelektronika 1**
 Name in English: **Power electronics 1**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, part-time**
 Kind of subject: **obligatory**
 Subject code: **ELR042362**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	20				
Number of hours of total student workload (CNPS):	81				
Form of crediting:	crediting with grade				
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

- Has basic knowledge of the behavior of the basic elements of electrical circuits with various types of current and voltage stimulus. Is able to correctly apply the learned principles and rights for the analysis of physical phenomena.
- Knows the trigonometry functions, exponential, logarithmic, indefinite integrals functions of one variable, Fourier series, which are necessary to understand and describe the phenomena in power electronic circuits.
- Is able to apply knowledge of calculus to the analysis of phenomena.
- Able to effectively use the acquired knowledge for the analysis of physical phenomena

SUBJECT OBJECTIVES

- C1. Familiarize students with the basic knowledge needed to understand the physical phenomena associated with nonlinear circuits.
 C2. Familiarize students with the methods of energy conversion using power semiconductor devices
 C3. Familiarize students with the basic topology and characteristics of power electronic systems
 C4. Student awareness of the positives and negatives arising from the practical application of power electronics systems.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

PEK_W01 It has a basic knowledge of power electronics systems

PEK_W02 It has a basic knowledge of the impact of power electronic converters on the AC network.

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

PEK_K01 It is aware of the importance and understanding of non-technical aspects and impacts of engineer

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction to the lecture, basic knowledge, , the program, requirements, credit. The types of power semiconductor devices (PPM). Static and dynamic parameters.	2
Lec 2	General power semiconductor switch requirements. Pararell operation of thyristors and diodes. Semiconductor power devices - short circuits, overcurrent and overvoltage protections.	2
Lec 3	1-pulse controlled rectifier under R, RL load. Discussion of the phenomena. Energy oscillation. Free-wheel diode. 1-pulse inverter. 2- and 3-pulse controlled rectifiers. Switch Requirements.	2
Lec 4	6- pulse controlled rectifier. Switch Requirements. Transformer for static convertors. The transformation of distorted waveforms, typical kVA rating of converter- and system-side winding power transformer. Guidelines for selection. Typical electrical quantity in the environment of distorted waveforms.	2
Lec 5	1 - and 3-phase AC regulators. Basic systems. Regulators with typical load. Advantages and disadvantages of contactless AC regulators.	2
Lec 6	D.C. switching regulators. Step- down and step-up regulators. Buck-boost converters.	2
Lec 7	Voltage-fed and current-fed inverters. The McMurray inverter. Series-Resonant inverters. Comparison of inverter techniques. Pulse Width Modulation. PWM inverter.	2
Lec 8	Negative effects of the line commutated converters (LCC). Energy qualityon the network loaded with power electronic systems. Typical hazards. Parameters describing the effects.	2
Lec 9	Active (APF) and passive (PPF) harmonic filters. Systems with reduced negative impact on the network.	2
Lec 10	Final test	2
Total hours:		20

TEACHING TOOLS USED
N1. Multimedia presentation
N2. Lecture

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS 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)	PEK_W01 PEK_W02 PEK_K01	Qualified test
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: <p>[1] Tunia H., Winiarski B., Podstawy energoelektroniki, WNT Warszawa 1980.</p> <p>[2] Barlik R., Nowak M., Technika tyrystorowa, WNT Warszawa 1994.</p> <p>[3] Borecki J., Stosur M., Szkółka S., Energoelektronika. Podstawy i wybrane zastosowania, Oficyna Wydawnicza Politechniki Wrocławskiej 2008.</p> <p>[4] Piróg S., Energoelektronika - negatywne oddziaływania układów energoelektronicznych na źródła energii i wybrane sposoby ich ograniczania, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1988.</p> <p>[5] B.M.Bird & K.G.King "Power electronics"; 1983 John Wiley&Sons.</p> <p>[6] M. H. Rashid" Power Electronics Handbook"; A Harcourt Science and Technology Company 1990; www.academicpress.com</p> <p>[7] M. P. Kaźmierkowski, Ramu Krishna, " Control in Power Electronics: Selected Problems"; Copyright 2002, Elsevier Science (USA); www.academicpress.com</p> SECONDARY LITERATURE: <p>[1] S.B.Dewan, G.R. Slemmon, A. Straughen, " Power Semiconductor Drives" ; 1984 John Wiley&Sons.</p> <p>[2] J. M. D. Murphy, F. G. Turnbull, "Power electronic control of AC motors" 1988</p> <p>[3] Piróg S., Energoelektronika. Układy o komutacji twardej, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1988.</p> <p>[4] Barlik R., Poradnik inżyniera energoelektronika, WNT Warszawa 1998.</p>

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR042362 - Power electronics 1
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	K1ETK_W25	C.1 C.2 C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.2
PEK_W02	K1ETK_W25	C.4	Lec8 Lec9	N.1 N.2
PEK_K01	K1ETK_K01	C.2	Lec1 Lec10	N.1