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:	**ELR052362**
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):	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. Has basic knowledge of the behavior of the basic elements of electrical circuits with various types of current and voltage stimulus.
2. 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.
3. Is able to apply knowledge of calculus to the analysis of phenomena.
4. 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 LEARNING OUTCOMES

relating to knowledge:

PEU_W01 It has a basic knowledge of powerelectronics systems

PEU_W02 It has a basic knowledge of the impact of power electronic conwerters on the AC network.

relating to skills:

relating to social competences:

PEU_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. Pararellel operation of thyrystors 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 LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02 PEU_K01	Qualified test
P(W)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE:
[1] Tunia H., Winiarski B.: Podstawy energoelektroniki, WNT, Warszawa 1987; [2] Barlik R., Nowak M.: Technika tyrystorowa, WNT Warszawa 1997; [3] Borecki J., Stosur M., Szkółka S.: Energoelektronika. Podstawy i wybrane zastosowania, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2008; [4] Piróg S.: Energoelektronika – negatywne oddziaływania układów energoelektronicznych na źródła energii i wybrane sposoby ich ograniczania, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1998;
SECONDARY LITERATURE:
[1] Piróg S.: Układy o komutacji sieciowej i o komutacji twardej, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 2006; [2] Barlik R., Nowak M.: Poradnik inżyniera energoelektronika Tom 1 i 2, Wydawnictwo Naukowe PWN (WNT), Warszawa 2019;

SUBJECT SUPERVISOR
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