

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, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR042303**
 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. 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. Able to correctly apply the knowledge of calculus to analyze natural 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 EDUCATIONAL EFFECTS*relating to knowledge:*

PEK_W01 It has a basic knowledge of electronics systems

PEK_W02 Basic knowledge of the impact for nonlinear circuits on the power AC network

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

PEK_K01 Is aware about the importance and non-technical aspects of an control engineer activities

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Basic knowledge, introduction to the lecture, the program, requirements, credit. The types of power semiconductor devices (PPM).	2
Lec 2	Static and dynamic parameters. PPM basic characteristics. General Power Semiconductor Switch Requirements.	2
Lec 3	Parallel operation of thyristors and diodes. Semiconductor power devices - short circuits, overcurrent and overvoltage protections.	2
Lec 4	1-pulse controlled rectifier under R, RL load. Discussion of the phenomena. Energy oscillation. Free-wheel diode. 1-pulse inverter.	2
Lec 5	2- and 3-pulse controlled rectifiers. Switch Requirements.	2
Lec 6	6- and 12- pulse controlled rectifier.	2
Lec 7	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 8	1 - and 3-phase AC regulators. Basic systems. Regulators with typical load. Advantages and disadvantages of contactless AC regulators.	2
Lec 9	Voltage-fed and current-fed inverters. The McMurray inverter. Series-Resonant inverters. Comparison of inverter techniques.	2
Lec 10	Pulse Width Modulation. PWM inverter. Sinusoidal pulse-width-modulation. Methods of forming voltage curve. Generation of PWM Signals. Harmonics reducing.	2
Lec 11	D.C. switching regulators. Step- down and step-up regulators. Buck-boost converters.	2
Lec 12	Direct frequency converters. Cycloconverters. Basic systems. Advantages and disadvantages of direct frequency conversion. Direct multiplier frequencies convertor.	2
Lec 13	Negative effects of the line commutated converters (LCC). Energy quality. Input power factor and harmonics.	2
Lec 14	Active (APF) and passive (PPF) harmonic filters. Practical principles of selecting power electronic systems.	2
Lec 15	Final test	2
Total hours:		30

TEACHING TOOLS USED
N1. Lecture.
N2. Multimedia presentation.

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	Final test
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Tunia H., Winiarski B., Podstawy energoelektroniki, WNT Warszawa 1980r. [2] Barlik R., Nowak M., Technika tyrystorowa, WNT Warszawa 1994. [3] Borecki J., Stosur M., Szkółka S., Energoelektronika. Podstawy i wybrane zastosowania, Oficyna Wydawnicza Politechniki Wrocławskiej 2008. [4] Piróg S., Energoelektronika - negatywne oddziaływania układów energoelektronicznych na źródła energii i wybrane sposoby ich ograniczania, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1988. SECONDARY LITERATURE: [1] Piróg S., Energoelektronika. Układy o komutacji twardej, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1988. [2] Barlik R., Poradnik inżyniera energoelektronika, WNT Warszawa 1998.

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR042303 - 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 Lec8 Lec9 Lec10 Lec11 Lec12	N.1 N.2
PEK_W02	K1ETK_W25	C.4	Lec13 Lec14	N.1 N.2
PEK_K01	K1ETK_K01	C.2	Lec1 Lec15	N.1