FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Teoria przekształtników statycznych**
Name in English:	**Theory of power 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:	**optional**
Subject code:	**ELR053222**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15			15	
Number of hours of total student workload (CNPS):	60			30	
Form of crediting:	examination			crediting with grade	
For group of courses mark (X) final course:					
Number of ECTS points:	2			1	
including number of ECTS points for practical (P) classes :				1	
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40			0.70	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. It has a basic knowledge of electronics and power electronic.
2. It has a basic knowledge of calculation steady state and transient conditions for linear and nonlinear circuits.
3. . It has a basic knowledge of automatic control systems.
4. It has a basic knowledge in the use of Fourier transform and its application to the analysis of non-sinusoidal waveforms.
5. Can apply knowledge of: differential calculus, integral and trigonometric series for the qualitative analysis of static states of linear and nonlinear circuits containing devices alignments and nonlinear components (power semiconductor devices).
6. Can apply knowledge of ordinary differential equations for the analysis of transients in electrical circuits.
7. He understands the need for continuing education and professional skills development.

SUBJECT OBJECTIVES

C1. Acquaint the student with the topology and properties of the converter DC to AC.
C2. Acquaint the student with the topology and properties of the converter DC to DC.
C3. Acquaint the student with the basic topologies and principle of operation of the DC power converters for AC.
C4. Acquaint the student with basic mathematical models and how to analyze operations converters.
C5. The acquisition of practical knowledge of basic design elements of the power converter circuits.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	It has an knowledge of the principles of operation of power converters.
PEU_W02	Knows the methods of mathematical description of converter systems.
PEU_W03	Understand basic physical principles of electrical energy conversion using static converters and the impact of this process on mains and equipment supplied with the converter.

relating to skills:

PEU_U01	Can design selected elements for the power electronic converter.
PEU_U02	He can obtain information from the literature and use them in the design process converters.

relating to social competences:

PEU_K01	He can think and act in a creative and enterprising.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Multi-pulse rectifiers with phase control. The waveforms of currents and voltages. Limiting the impact on mains	2
Lec 2	Operation Inverter controlled rectifiers. Reversing Systems. Converter transformers.	2
Lec 3	Switching DC converters. Step-down, and step-up converters.	2
Lec 4	Three-phase voltage inverters. Methods for control output voltage and current. Multilevel inverters.	2
Lec 5	Current source inverters (CSI). PWM techniques in CSI.	2
Lec 6	Interaction converters on mains and electric energy consumers.	2
Lec 7	Interaction converters on mains and electric energy consumers.	2
Lec 8	Cooperation power converters with the autonomous energy sources.	1
	Total hours:	**15**

Form of classes - project		**Number of hours:**
Proj 1	Design of power circuit for six-pulse thyristor controlled rectifier.	2
Proj 2	Design electrical circuit for cross-system the rectifier.	2
Proj 3	Design of step-up DC converter.	2
Proj 4	Design of three-phase transistor voltage inverter.	2
Proj 5	Design of multi-level voltage inverter.	2
Proj 6	Design of step-down DC converter.	2
Proj 7	Design of resonant converter.	2
Proj 8	Credit of the project.	1
	Total hours:	**15**

TEACHING TOOLS USED
N1. Informative lecture using presentation slides.
N2. Discussion of design tasks in class in the auditorium.
N3. Consultation.

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_W03	Written exam
F2(W)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	Oral exam.
P(W)	P=0,4*F1+0,6*F2	
F1(P)	PEU_W01 PEU_W02 PEU_W03 PEU_U01 PEU_U02 PEU_K01	Quality assessment of the implementation of the project.
P(P)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Tunia H., Winiarski B.: Energoelektronika. Warszawa WNT 1994.
[2] Barlik R., Nowak M.: Technika tyrystorowa. Warszawa WNT 1994.
[3] Barlik R., Nowak M. :Poradnik inżyniera energoelektronika. Warszawa WNT 2014.
[4] Januszewski S., Świątek H., Zymmer K.: Półprzewodnikowe przyrządy mocy. Warszawa WKŁ 1999.
[5] Frąckowiak L., Januszewski S.,: Energoelektronika część 1. Wydawnictwo Politechniki Poznańskiej.2001.
[6] Frąckowiak L.: Energoelektronika część 2. Wydawnictwo Politechniki Poznańskiej.1998.

SECONDARY LITERATURE:

[1] Piróg S.: Energoelektronika. Kraków Wydawnictwo AGH 2006.
[2] Nowacki Z.: Modulacja szerokości impulsów w napędach przekształtnikowych prądu przemiennego.
[3] Tunia H., Winiarski B.: Podstawy energoelektroniki. Warszawa WNT 1987.
[4] Tunia H., Kaźmierkowski M.: Automatyka napędu przekształtnikowego. Warszawa PWN 1987.
[5] Strzelecki R., Supronowicz H.: Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy. Warszawa Oficyna Wydawnicza Politechniki Warszawskiej. 2000.
[6] Mikołajuk K.: Podstawy analizy obwodów energoelektronicznych. Warszawa PWN 1998

SUBJECT SUPERVISOR

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