

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Przekształtniki statyczne w elektroenergetyce**  
 Name in English: **Static converters in electric power engineering**  
 Main field of study (if applicable): **Industrial Control Engineering**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **optional**  
 Subject code: **APR012302**  
 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):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Knows fundamental power electronic systems  
He has knowledge of the properties of functions (trigonometric, exponential, logarithmic), differential calculus,
2. indefinite integrals of functions of one variable, Fourier series, they need to understand and describe phenomena in power electronic circuits.
3. He can correctly apply the knowledge of metrology of electrical nonlinear circuits. It can be measured in a non-linear circuits.
4. Is able to teamwork

**SUBJECT OBJECTIVES**

- C1. The advisability of converting electrical energy using power semiconductor device
- C2. Basic knowledge of the various fields of application of static converters in power engineering. The effects of the negative impact of converters on both the supply network and automation systems.
- C3. Positive and negative effects of using power electronics systems
- C4. Computer simulation using TCAD package 7.
- C5. Familiarize students with typical control systems of static converters.
- C6. Knowledge of key areas of application static converters in power systems
- C7. Test methods effects of the negative impact of static converters.
- C8. Disturbances research results and the way to develop.

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 A basic knowledge regard to areas of applications of static converters in power engineering  
 PEU\_W02 Know the effects of the negative impact of power electronics systems on both the supply network and automation systems

*relating to skills:*

- PEU\_U01 It can be used known phenomenon to evaluate run correctly of static converters in an environment control systems.  
 PEU\_U02 He can prepare the documentation on the implementation of engineering tasks

*relating to social competences:*

- PEU\_K01 Is aware of the responsibility for their own work

## PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Introduction, introduction to the lecture, program requirements, credit. Basic systems converters in automation, power generation and industry. Limitations, advantages and disadvantages.	2
Lec 2	The converter as part of executive control systems. Examples of applications in automation. Contactless switches as implementing elements of automation systems.	2
Lec 3	Rotary converters and uninterruptible power supplies for automatic systems.	2
Lec 4	Semiconductor excitation systems of synchronous machines. Restrictions. Rules for selection of AGP automation.	2
Lec 5	Static VAR compensator (SVC). Active power filters (APF). High voltage directed current (HVDC).	2
Lec 6	Interferences generated by basic converter circuits supplying DC and AC motors. Measures to limit disturbances and their conditions of use.	2
Lec 7	Negative impact on the supply network and automation systems. Means and ways to reduce the impact of static converters on automation systems.	2
Lec 8	Qualified test.	1
Total hours:		<b>15</b>

Form of classes - laboratory		Number of hours:
Lab 1	Introduction to laboratory. Safety regulations. Exercises plan.	1
Lab 2	Static VAR compensator with inductive current controller.	2
Lab 3	Naturally commutating 6-pulse inverter. High voltage directed current (HVDC).	2
Lab 4	Soft-Start systems.	2
Lab 5	The negative impact of static converters on mains and components for automation systems.	2
Lab 6	AC converters with a reduced impact on the AC network.	2
Lab 7	Passive harmonic filters. Computer simulation using TCAD packet.	2
Lab 8	Conclusions. Pass.	2
Total hours:		<b>15</b>

## TEACHING TOOLS USED

- N1. Multimedia presentation
- N2. Check the predisposition in the form of short tests.
- N3. Discussion of the scope of research
- N4. Discussion of the measurement methods and physical model.
- N5. Implementation of the protocol of the research.
- N6. Execution of test reports including analysis of results.

## EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02	Colloquium (final test)
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_K01	Activity during laboratory classes
F2(L)	PEU_U01 PEU_U02 PEU_K01	Oral questions or pre-test (preparation for laboratory classes)
F3(L)	PEU_U02 PEU_K01	Report from laboratory exercises
P(L)	$P = 0,1 F1 + 0,6 F2 + 0,3 F3$	

<b>PRIMARY AND SECONDARY LITERATURE</b>
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<b>PRIMARY LITERATURE:</b>
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| <p>[1] Charoy Alain: Kompatybilność elektromagnetyczna – zakłócenia w urządzeniach elektronicznych, WNT, Warszawa 2000;</p> <p>[2] Borecki J., Stosur. M, Szkółka S.: Energoelektronika. Podstawy i wybrane zastosowania, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2008;</p> <p>[3] Piróg S.: Energoelektronika – negatywne oddziaływania układów energoelektronicznych na źródła energii i wybrane sposoby ich ograniczania, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1998;</p> <p>[4] Barlik R., Nowak M.: Poradnik inżyniera energoelektronika Tom 1 i 2, Wydawnictwo Naukowe PWN (WNT), Warszawa 2019;</p> <p>[5] Dmowski A.: Energoelektroniczne układy zasilania prądem stałym, WNT, Warszawa 1998;</p> <p>[6] Tunia H., Winiarski B.: Podstawy energoelektroniki, WNT, Warszawa 1987;</p> |
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<b>SECONDARY LITERATURE:</b>
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| <p>[1] Büchner P.: Stromrichter-Netzurückwirkungen und ihre Beherrschung, VEB Deutscher Verlag für Grundstoffindustrie, Leipzig 1982;</p> <p>[2] E-Czasopismo: AUTOMATYKA, ELEKTRYKA, ZAKŁÓCENIA (<a href="https://epismo-aez.pl">https://epismo-aez.pl</a>);</p> |
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<b>SUBJECT SUPERVISOR</b>
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