

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): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **optional**  
 Subject code: **ARR042302**  
 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 EDUCATIONAL EFFECTS***relating to knowledge:*

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

*relating to skills:*

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

*relating to social competences:*

- PEK\_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	Basic DC motor drives. Basic AC motor drives. PWM inverters. Disturbances generated by PWM inverters. Measures restricting the disturbances	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 EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02	test
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_K01	Activity
F2(L)	PEK_U01 PEK_U02 PEK_K01	short tests
F3(L)	PEK_U02 PEK_K01	test report
P(L)	$P = 0,1 F1 + 0,6 F2 + 0,3 F3$	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] Charoy Alain, Kompatybilność elektromagnetyczna – zakłócenia w urządzeniach elektronicznych, WNT, Warszawa 2000.
- [2] Borecki J., Stosur. M, Szkółka S., Energoelektronika. Podstawy i wybrane zastosowania, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2008
- [3] Piróg S. ,Energoelektronika – negatywne oddziaływania układów energoelektronicznych na źródła energii i wybrane sposoby ich ograniczania, AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, Kraków 1988.
- [4] Barlik R., Poradnik inżyniera energoelektronika, WNT ,Warszawa 1998.
- [5] Dmowski A., Energoelektroniczne układy zasilania prądem stałym, WNT, Warszawa 1998.
- [6] Tunia H., Winiarski B., Podstawy energoelektroniki, WNT, Warszawa 1980.

### SECONDARY LITERATURE:

- [1] Büchner ,Stromrichter-Netzrückwirkungen und ihre Beherrschung,VEB Deutscher Verlag für Grundstoff- industrie, Leipzig 1982
- [2] E-Czasopismo: AUTOMATYKA, ELEKTRYKA, ZAKŁÓCENIA,  
<http://www.elektro-innowacje.pl>

## SUBJECT SUPERVISOR

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### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ARR042302 - Static converters in electric power engineering** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

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	K1AIR_ASE_W09	C.2 C.3 C.6	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6	N.1
PEK_W02	K1AIR_ASE_W09	C.3 C.4 C.7	Lec7	N.1
PEK_U01	K1AIR_ASE_U08	C.8	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7	N.2 N.3 N.4 N.5 N.6
PEK_U02	K1AIR_ASE_U08	C.7 C.8	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.5 N.6
PEK_K01	K1AiR_K09	C.1 C.2 C.3 C.4 C.5 C.6 C.8	Lec1 Lec8 Lab1 Lab8	N.3