FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Komputerowo wspomagane modelowanie i projektowanie układów sterowania**
Name in English:	**Computer aided modeling and design of control systems**
Main field of study (if applicable):	**Control Engineering and Robotics**
Specialization (if applicable):	**Automation of Machines, Vehicles and Apparatus**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ARR043222**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30			30	
Number of hours of total student workload (CNPS):	30			90	
Form of crediting:	crediting with grade			crediting with grade	
For group of courses mark (X) final course:					
Number of ECTS points:	1			3	
including number of ECTS points for practical (P) classes :				3	
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70			2.10	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. He has an extended knowledge of the stability analysis of linear and nonlinear control systems; he have knowledge on prototyping systems
2. He has a basic knowledge of programming in Matlab / Simulink. He knows the methods of mathematical calculations (matrix, derivative etc.), analysis and synthesis of simple control systems
3. He has a basic knowledge of differential equations and linear differential equations (Laplace transform theory)
4. He is able to use the knowledge of differential and integral calculus in the problems connected with the engineering studies
5. He can formulate an algorithm, he can create code in Matlab and Simulink to develop computer programs to analysis and synthesis of control systems

SUBJECT OBJECTIVES

C1. Familiarizing students with the basic knowledge necessary to understand the ideas and principles of computer modeling and design of automatic control systems

C2. Informing the student the possibility to use different techniques and computer analysis tools to use in the engineering practice

C3. Manufacturing of the ability to apply computer modeling techniques for complex drive systems with AC and DC motors

C4. The acquisition of practical knowledge and the ability to combine high current systems with control systems

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01	He has a broader and deeper knowledge of the possible use of computer tools for research and analysis of power electronics systems and modern control systems
PEK_W02	He understand the methodology of designing complex electronic systems; know computer programming languages and tools for the design and simulation of circuits and systems
PEK_W03	He has the knowledge in the design of control systems of electric drives using programs SimPower, PSIM, SIMPLORER, PLECS

relating to skills:

PEK_U01	He can take advantage of known methods and mathematical models - if necessary, modify them - for the analysis and design using known methods for computer-aided modeling
PEK_U02	He can design automatic control systems, electronic components,
PEK_U03	He can integrate the knowledge in the field of power electronic, taking into account the non-technical aspects (including economic and legal)

relating to social competences:

PEK_K01	He can think and act in a creative and enterprising

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction, the main goal of the lecture, credit requirements	2
Lec 2	Computer-aided design and automatic control systems - basic definitions	2
Lec 3	Graphical methods for the design of complex power electronic systems	2
Lec 4	Graphical methods for the design of complex power electronic systems	2
Lec 5	Graphical methods for the design of complex power electronic systems	2
Lec 6	Modeling of automation control systems	2
Lec 7	Modeling of automation control systems	2
Lec 8	Modeling of automation control systems usin the PSIM software	2
Lec 9	Modeling of automation control systems usin the PSIM software	2
Lec 10	Computer-aided design of complex automatic control systems using the PLECS software - on the example of the speed control of DC motor	2
Lec 11	Computer-aided design of complex automatic control systems using the PLECS software - on the example of the speed control of AC motor	2
Lec 12	Computer-aided design of complex automatic control systems using the SimPower software – electrical drives	2
Lec 13	Computer-aided design of complex automatic control systems using the SimPower software – electrical drives	2
Lec 14	Computer-aided design of complex automatic control systems using the SimPower software – electrical drives	2
Lec 15	Tools for computer analysis of control systems - the comparative analysis. Assessment	2
	Total hours:	**30**

Form of classes - project		**Number of hours:**
Proj 1	Presentation of the Rules of Procedure Health and Safety Laboratory. Establish rules for passing. General knowledge of the workplace. Discussion of the rules for the implementation of projects.	2
Proj 2	Information about the software SIMPLORER, TCAD, PSIM - modeling rectifiers 3D, 4D, 6D, 4T, 6T	2
Proj 3	Introduction to Software SimPower, PLECS - Modeling the drive and modulation algorithm	2
Proj 4	Project realization in a PSIM software	12
Proj 5	Project realization in a Plecsim software	10
Proj 6	Passing the project	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Lecture with audio-visual technology, multimedia presentations, transparencies.
N2. presentation of the project, consultations, etc.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEK_W01 PEK_W02 PEK_W03	final test
F2(W)	PEK_K01	presence at the lecture
P(W)	P=0.1*F2+0.9*F1	
F1(P)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Verification and evaluation of project preparation
F2(P)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Activity in the classroom project
F3(P)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Evaluation of the project and the form of its presentation
P(P)	P=0.2*F1+0.1*F2+0.7*F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Zbigniew Łukasik, Laboratorium komputerowej symulacji układów automatyki, Wydawnictwo Politechniki Radomskiej Rok wydania: 2009
[2] Benjamin C. Kuo, Farid Golnaraghi, Automatyczne systemy sterowania, Wiley 2003
[3] Pawlaczyk, Leszek. Energoelektronika : ćwiczenia laboratoryjne , Wrocław : Oficyna Wydawnicza Politechniki Wrocławskiej, 2005
[4] Koczara, Włodzimierz, Wprowadzenie do napędu elektrycznego, Warszawa : Oficyna Wydawnicza Politechniki Warszawskiej, 2012

SECONDARY LITERATURE:

[1] Orłowska-Kowalska, Teresa, Bezczujnikowe układy napędowe z silnikami indukcyjnymi,
Wrocław : Oficyna Wydawnicza Politechniki Wrocławskiej, 2003

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR043222 - Computer aided modeling and design of control systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**
AND SPECIALIZATION **Automation of Machines, Vehicles and Apparatus**

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	S2AMPU_W08	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_W02	S2AMPU_W08	C.2 C.3 C.4	Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_W03	S2AMPU_W08	C.2	Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_U01	S2AMPU_U07	C.2 C.3 C.4	Proj1 Proj2 Proj3 Proj4 Proj5 Proj6	N.2
PEK_U02	S2AMPU_U07	C.2 C.3 C.4	Proj1 Proj2 Proj3 Proj4 Proj5 Proj6	N.2
PEK_U03	S2AMPU_U07	C.2 C.3 C.4	Proj1 Proj2 Proj3 Proj4 Proj5 Proj6	N.2
PEK_K01	K2AiR_K06	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15 Proj1 Proj2 Proj3 Proj4 Proj5 Proj6	N.1 N.2