

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Komputerowo wspomagane modelowanie i projektowanie układów regulacji**
 Name in English: **Computer aided modeling and design of the control system**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Industrial Electrical Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ELR043213**
 Group of courses: **NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has a basic knowledge of automation, informatics and modeling.

SUBJECT OBJECTIVES

- C1. The acquisition expanded knowledge of the design and modeling of control systems for various objects. Learning and expanding knowledge of linear control algorithms PI / PID controllers state regulators plain, fuzzy, adaptive systems, and methods of estimation of the state variables of dynamic objects.
- C2. Gaining skills in modeling and design of complex buildings and industrial processes and their critical analysis.
- C3. The acquisition and consolidation of social skills including creative activity.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Student has an extended knowledge of the design and modeling of control systems for various objects using linear methods.
- PEK_W02 Student has knowledge fuzzy, predictive and adaptive control structures and methods of estimation of the state variables of dynamic objects.

relating to skills:

- PEK_U01 Student can model advanced control system based on the linear control theory.
- PEK_U02 Student can model and analyse complex control system based on linear, non-linear and adaptive theory.

relating to social competences:

- PEK_K01 Understands the needs for team work on finding and improving the methods of problem solving.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Organizational matters. Classification of control systems. Cascade control structure.	2
Lec 2	Control structure with the state space controller.	2
Lec 3	Fuzzy Control - basic definitions, systems (Mamdani, TSK), the method for selecting the parameters.	4
Lec 4	Adaptive control - types of, design	2
Lec 5	Predictive Control - operating principle, the structure of the predictive controller, properties.	2
Lec 6	State variable estimators.	2
Lec 7	Summary	1
Total hours:		15

Form of classes - laboratory		Number of hours:
Lab 1	Organizational matters. Modeling the basic systems in Matlab-Simulink	2
Lab 2	Modeling of the cascade control structure for the selected dynamic object. The use of different methods for selection of the parameters of the controller. Anti-windup system.	4
Lab 3	Modeling of the control structure with state-controller for the selected dynamic object	4
Lab 4	Modeling of the fuzzy control structure for the selected dynamic object.	6
Lab 5	Modeling of the adaptive control structure for selected dynamical plant	4
Lab 6	Modeling of the model predictive control structure for the selected object	4
Lab 7	Modeling of the state estimators for selected plants	4
Lab 8	Summary	2
Total hours:		30

TEACHING TOOLS USED

- N1. A multimedia presentation with elements of traditional lecture
 N2. Consultation
 N3. Writting and oral tests

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	Written tests
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_K01	Rate of programs
P(L)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] T. Kaczorek, A. Dzieliński, W. Dobrowolski, R. Łopatka. Podstawy teorii sterowania, WNT, 2005
 [2] Piotr Tatjewski Sterowanie zaawansowane obiektów przemysłowych. Struktury i algorytmy, Exit 2002.
 [3] Piegat A., Modelowanie sterowanie i rozmyte, Akademicka Oficyna Wydawnicza EXIT, 1999
 [4] Rutkowska D., Piliński M., Rutkowski L., Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, 1997

SECONDARY LITERATURE:

- [1] K. Ogata - Modern Control Engineering
 [2] V. Utkin, J. Guldner, J. Shi, Sliding Mode Control in Electromechanical Systems, Taylor & Francis, 1999.
 [3] A.H. Glattfelder, W. Schaufelberger, Control Systems with Input and Output Constrains, Springer, 2003.

SUBJECT SUPERVISOR

Krzysztof Szabat, krzysztof.szabat@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR043213 - Computer aided modeling and design of the control system
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Industrial 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	S2ETP_W06	C.1	Lec1 Lec2	N.1 N.2
PEK_W02	S2ETP_W06	C.1	Lec3 Lec4 Lec5 Lec6 Lec7	N.1 N.2
PEK_U01	S2ETP_U03	C.2	Lab1 Lab2 Lab3	N.2 N.3
PEK_U02	S2ETP_U03	C.2	Lab4 Lab5 Lab6 Lab7 Lab8	N.2 N.3
PEK_K01	K2ETK_K06	C.3	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.1 N.2 N.3