FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Teoria sterowania**
Name in English:	**Control theory**
Main field of study (if applicable):	**Control Engineering and Robotics**
Specialization (if applicable):	**Automation and Control in Electrical Power Systems**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**obligatory**
Subject code:	**ARR042112**
Group of courses:	**NO**

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

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. A student should know notations used in control system theory, to know types of control systems and characteristics of control system elements.
2. Astudent should have the basic knowledge of control systems.
3. A student should know how to analyze simple control systems and arrange and rearrange block diagrams of control systems.
4. A student should have ability to work individually.

SUBJECT OBJECTIVES

C1. Skill in stability analysis of linear and nonlinear control systems.
C2. Skill in designing of control algorithms for models of various type control plants.
C3. Skill in solving linear-quadratic problems.
C4. Skill in formulating and solving optimal control problems.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 A student gets the knowledge of feedforward and feedback control systems design.
PEK_W02 A student gets the knowledge of optimal control systems design.
PEK_W03 A student gets the knowledge of probabilistic plant control systems design.

relating to skills:

relating to social competences:

PEK_K01 A student can act independently working on a complex engineering project.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Models of continuous system. Models of discrete system.	2
Lec 2	Open-loop control system design methods. Feedback control system design methods.	2
Lec 3	Controllability. Observability. Lyapunov stability.	2
Lec 4	Global stability. Linear-quadratic optimal control problem.	2
Lec 5	Deterministic optimal control.	2
Lec 6	Dynamic programming. Optimal control of continuous systems.	2
Lec 7	Bellman's equation. Time-optimal control.	2
Lec 8	Estimation of an unknown parameter measured under disturbances.	2
Lec 9	Maximum likelihood method.	2
Lec 10	Minimal risk method.	2
Lec 11	Extreme control.	2
Lec 12	Feedback based extreme control.	2
Lec 13	No-gradient based extreme control. Gradient based extreme control.	2
Lec 14	Tentative step extreme control.	2
Lec 15	Artificial intelligence and knowledge representation in control systems.	2
	Total hours:	**30**

TEACHING TOOLS USED
N1. Multimedia presentation. N2. Consultation

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 PEK_K01	examination
P(W)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Bubnicki Z., Teoria i algorytmy sterowania, PWN, Warszawa 2002. [2] Kaczorek T., Teoria układów regulacji automatycznej, WNT, Warszawa 1977. [3] Kaczorek T., Teoria sterowania, T.1. Układy liniowe ciągłe i dyskretne, PWN, Warszawa 1977. [4] Kaczorek T., Teoria sterowania, T.2. Układy nieliniowe, procesy stochastyczne. oraz optymalizacja statyczna i dynamiczna, PWN, Warszawa 1981. [5] Kaczorek T., Teoria sterowania i systemów. wyd.2 popr., PWN, Warszawa 1996. **SECONDARY LITERATURE:** [1] Philippe de Larminant, Yves Thomas., Automatyka-układy liniowe. T. I, II, III. [2] Zbiór zadań i problemów z teorii sterowania. pod red. Zdzisława Bubnickiego, Oficyna Wyd. PWr, Wrocław 1979

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR042112 - Control theory
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**
AND SPECIALIZATION **Automation and Control in Electrical Power Systems**

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	K2AiR_W02	C.2	Lec1 Lec2 Lec3	N.1 N.2
PEK_W02	K2AiR_W01	C.3 C.4	Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2
PEK_W03	K2AiR_W03	C.2 C.3 C.4	Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1 N.2
PEK_K01	K2AiR_K01 K2AiR_K02 K2AiR_K03 K2AiR_K04	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 N.2