

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 of Machines, Vehicles and Apparatus**
 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. A student 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 <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 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 Larminat, 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 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	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