FACULTY OF ELECTRICAL ENGINEERING

SUBJECT CARD

Name in Polish:	**Podstawy automatyki 1**
Name in English:	**Fundamentals of control engineering 1**
Main field of study (if applicable):	**Electrical Engineering**
Specialization (if applicable):	
Level and form of studies:	**1st level, part-time**
Kind of subject:	**obligatory**
Subject code:	**ELR052161**
Group of courses:	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	20	10			
Number of hours of total student workload (CNPS):	90	30			
Form of crediting:	examination	crediting with grade			
For group of courses mark (X) final course:					
Number of ECTS points:	3	1			
including number of ECTS points for practical (P) classes :		1			
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10	0.70			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of fundamentals of electrotechnics, differential calculus and complex functions and numbers.
2. Practical ability to use differential calculus and complex functions.
3. Ability of application of Laplace and Fourier transform.

SUBJECT OBJECTIVES

C1. Gaining theoretical knowledge concerning static, dynamic and quality as well as stability of continuous linear control systems .

C2. Gaining theoretical knowledge concerning compensation allowing to get required parameters of control systems.

C3. Gaining practical abilities of mathematical analysis, synthesis, stability estimation and design of adequate compensation of to continuous linear control systems.

C4. Gaining abilities of practical analysis and synthesis of continuous linear control systems.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01	Has knowledge to build models , to estimate and calculate static and dynamic parameters of fundamental blocks of control systems.
PEU_W02	Has knowledge concerning analysis, operation and quality of control systems.
PEU_W03	Has knowledge concerning stability of control systems, development of compensation systems as well as improvement and optimisation of continuous linear control systems.

relating to skills:

PEU_U01	Is able to work out mathematical analysis and synthesis of fundamental elements and complex control systems.
PEU_U02	Is able to make practical estimation of stability of control systems and design different types of compensators allowing to reach required performance of continuous linear control systems.

relating to social competences:

PEU_K01	Is aware of necessity of self-reliant information retrieval and creative using of obtained information.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours:**
Lec 1	Introduction. Rules to pass. Classification and structure of control systems. Methods of description of control systems.	2
Lec 2	Basic control systems elements - elements: proportional, first order, integrating - ideal and with inertia, differentiating - ideal and with inertia.	2
Lec 3	Basic control systems elements – second order inertial element, second order oscillatory element.	2
Lec 4	Requirements for performance of control systems, performance indexes. Fundamentals of block-diagram algebra	2
Lec 5	Block-diagram algebra. Steady state performance of control systems.	2
Lec 6	Stability - definition, basic stability condition. Routh stability criterion.	2
Lec 7	Nyquist stability criterion - left-hand side criterion, logarithmic criterion.	2
Lec 8	Stability analysis based on Ziegler-Nichols approximation. Methods of compensation of control systems.	2
Lec 9	Synthesis of the series compensating units with use of the Nichols chart.	2
Lec 10	Compensation techniques: parallel, in feedback, additive and predictive. Industrial controllers - types, construction, selection of the settings.	2
	Total hours:	**20**

Form of classes - class		**Number of hours:**
Cl 1	Introduction. Requirements to pass. Laplace transform and its application. Impulse and step time responses of fundamental blocks of control system.	2
Cl 2	Time and frequency characteristics of control systems.	2
Cl 3	Block-diagram algebra of continuous control systems. Steady state errors.	2
Cl 4	Stability analysis of control systems: Routh criteria. – Nyquist criterion. logarithmic criterion, determination of phase and gain margins.	2
Cl 5	Pass test.	2
	Total hours:	**10**

TEACHING TOOLS USED
N1. Informative lecture
N2. Classes
N3. Student's own work

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation *F – forming (during semester)* *P – concluding (at semester end)*	**Educational effect number**	**Way of evaluating educational effect achievement**
F1(W)	PEU_W01 PEU_W02 PEU_W03	Presence at the lectures
F2(W)	PEU_W01 PEU_W02 PEU_W03	Written or oral examination
P(W)	P=0,1F1+0,9F2	
F1(C)	PEU_U01 PEU_U02 PEU_K01	Activity at the classes
F2(C)	PEU_U01 PEU_U02	Results of short tests
F3(C)	PEU_U01 PEU_U02	Crediting test
P(C)	P=0,2F1+0,2F2+0,6F3	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

Greblicki W., Podstawy automatyki, Wydawnictwo Politechniki Wrocławskiej, Wrocław 2006
[1] Kaczorek T., Podstawy teorii sterowania, WNT, Warszawa 2009
[2] Mazurek J., Vogt H., Żydanowicz W, .Podstawy automatyki, Wydawnictwo Politechniki Warszawskiej, Warszawa 2006
[3] Staszewski J., Skrypt zadań z Podstaw Automatyki *

* position available from the lecturer

SECONDARY LITERATURE:

[1] Horla D., Podstawy automatyki. Ćwiczenia rachunkowe. Cz.1, Wydawnictwo Politechniki Poznańskiej, Poznań 2004
[2] Mazur E., Sosnowski M.; Podstawy automatyki. Zbiór zadań, Wydawnictwo Politechniki Częstochowskiej, Częstochowa 2006.

SUBJECT SUPERVISOR

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