

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: **ELR042161**  
 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):	81	27			
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 EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 Has knowledge to build models , to estimate and calculate static and dynamic parameters of fundamental blocks of control systems.  
 PEK\_W02 Has knowledge concerning analysis, operation and quality of control systems.  
 PEK\_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:*

- PEK\_U01 Is able to work out mathematical analysis and synthesis of fundamental elements and complex control systems.  
 PEK\_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:*

- PEK\_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:		<b>20</b>

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:		<b>10</b>

## TEACHING TOOLS USED

- N1. Informative lecture  
 N2. Classes  
 N3. Student's own work

## 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	Presence at the lectures
F2(w)	PEK_W01 PEK_W02 PEK_W03	Written or oral examination
P(w)	$P=0,1F1+0,9F2$	
F1(c)	PEK_U01 PEK_U02 PEK_K01	Activity at the classes
F2(c)	PEK_U01 PEK_U02	Results of short tests
F3(c)	PEK_U01 PEK_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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### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **ELR042161 - Fundamentals of control engineering 1** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **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	K1ETK_W05 K1ETK_W27	C.1 C.2	Lec1 Lec2 Lec3	N.1 N.3
PEK_W02	K1ETK_W05 K1ETK_W27	C.1 C.2	Lec4 Lec5	N.1 N.3
PEK_W03	K1ETK_W05 K1ETK_W27	C.1 C.2	Lec6 Lec7 Lec8 Lec9 Lec10	N.1 N.3
PEK_U01	K1ETK_U14 K1ETK_U24	C.3 C.4	CI1 CI2 CI3 CI5	N.2 N.3
PEK_U02	K1ETK_U14 K1ETK_U24	C.3 C.4	CI3 CI4 CI5	N.2 N.3
PEK_K01	K1ETK_K05	C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 CI1 CI2 CI3 CI4	N.1 N.2 N.3