

DESCRIPTION OF THE COURSES

- Course code: ELR2102
- Course title: FUNDAMENTALS OF CONTROL ENGINEERING 1
- Language of the lecture: Polish

<i>Course form</i>	<i>Lecture</i>	<i>Classes</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Number of hours/week*</i>	2	1			
<i>Number of hours/semester*</i>	30	15			
<i>Form of the course completion</i>	pass	pass			
<i>ECTS credits</i>	2	1			
<i>Total Student's Workload</i>	60	30			

- Level of the course (basic/advanced): basic
- Prerequisites:
completed course: Fundamentals of Electrical Circuits Theory
- Name, first name and degree of the lecturer/supervisor:
Janusz Szafran, Prof., Ph. D., D. Sc.
- Names, first names and degrees of the team's members:
Andrzej Wiszniewski, Prof., Ph. D., D. Sc.
Jan Iżykowski, dr hab. inż., prof. PWr.
Waldemar Rebizant, Ph. D., D. Sc.
Marek Michalik, Ph. D.
Mirosław Łukowicz, Ph. D.
Janusz Staszewski, Ph. D.
- Year: 3 Semester: 5
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):
As an effect of the course completion the students are expected to present the knowledge on the theory of control systems, control quality, stability of closed-loop systems as well as design and analysis of industrial controllers and compensation units. The students should show the ability of solving practical problems related to the theory presented during lectures.
- Form of the teaching (traditional/e-learning): traditional
- Course description:
The course FUNDAMENTALS OF CONTROL ENGINEERING 1 consists of the lecture and the laboratory. It deals with the following problems: structure of open and closed-loop control systems, description of linear continuous dynamic elements, block diagram algebra, static features, stability of control systems and its analysis, compensation techniques, industrial controllers.
- Lecture:

<i>Particular lectures contents</i>	<i>Number of hours</i>
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1. <i>Introduction. Classification and structure of control systems.</i>	2
2. <i>Description of control systems.</i>	2
3. <i>Basic control systems elements - elements: proportional, first order, integrating - ideal and with inertia, differentiating - ideal and with inertia.</i>	2
4. <i>Basic control systems elements – second order inertial element, second order oscillatory element.</i>	2
5. <i>Basic control systems elements – elements with transport delay.</i>	2
6. <i>Requirements for performance of control systems, performance indexes.</i>	2
7. <i>Block-diagram algebra.</i>	2
8. <i>Steady state performance of control systems.</i>	2
9. <i>Stability - definition, basic stability condition. Routh stability criterion.</i>	2
10. <i>Nyquist stability criterion - left-hand side criterion, logarithmic criterion.</i>	2
11. <i>Stability analysis based on Ziegler-Nichols approximation.</i>	2
12. <i>Methods of compensation of control systems.</i>	2
13. <i>Synthesis of the series compensating units with use of the Nichols chart.</i>	2
14. <i>Compensation techniques: parallel, in feedback, additive and predictive.</i>	2
15. <i>Industrial controllers - types, construction, selection of the settings.</i>	2

- Classes – the contents:

1. Impulse response and Laplace transfer function of control systems, output response of control systems under unit step input signal.
2. Frequency characteristics: polar plot, logarithmic of amplitude and phase of basic control elements.
3. Block-diagram algebra of continuous control systems
4. Characteristics of oscillatory element, calculation of steady state errors.
5. Stability analysis for control systems: Routh criterion.
6. Stability analysis – Nyquist criterion, determination of phase and gain margins.
7. Pass test.

- Seminars – the contents:

- Laboratory – the contents:

- Project – the contents:

- Basic literature:

- [1] Kaczorek T., Teoria sterowania i systemów, PWN, Warszawa 1999.
- [2] Greblicki W. Podstawy automatyki, PWr, Wrocław, 2001.
- [3] Kowal J., Podstawy automatyki, t. 1 i 2, AGH, Kraków, 2004.
- [4] Larminant P., Thomas Y., Automatyka - układy liniowe., WNT, Warszawa 1983.
- [5] Wiszniewski A. (pod red.), Podstawy automatyki. Ćwiczenia laboratoryjne, skrypt Politechniki Wrocławskiej, Wrocław 2000.

- Additional literature:

- [1] Katsuhiko Ogata, Modern control engineering, Prentice-Hall International Editions.

[2] Francis H. Raven, Automatic control engineering, International Student Edition.

- Conditions of the course acceptance/creditation:
Students have to be familiar with the material delivered during the lecture – in particular to be able of solving the examples. Note: the list of the sample problems is available at the web side <http://zas.ie.pwr.wroc.pl/>

* - depending on a system of studies