DESCRIPTION OF THE COURSES

- Course code: ELR2104
- Course title: FUNDAMENTALS OF CONTROL ENGINEERING 2
- Language of the lecturer: polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*		*2*		
*Number of hours/semester**	*30*		*30*		
Form of the course completion	*exam*		*pass*		
ECTS credits	*4*		*2*		
Total Student's Workload	*120*		*60*		

- Level of the course (basic/advanced): basic
- Prerequisites:
  completed course: Fundamentals of Control Engineering 1
- 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: 6
- 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 discrete and non-linear control systems, their quality, stability as well as design and analysis of industrial controllers and compensation units for discrete control systems. 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 consists of the lecture and the laboratory. The laboratory covers the syllabus of both courses: FUNDAMENTALS OF CONTROL ENGINEERING 1 and 2, while the lecture deals with the following topics: structure of discrete control systems, difference equations, discrete transfer function, block-diagram algebra. Steady state errors, stability analysis of discrete control systems, state space methods of discrete control systems description. Non-linear control systems - method of describing function and methods of stability analysis.
- Lecture:

Particular lectures contents	*Number of hours*
A. DISCRETE CONTROL SYSTEMS.	
1. Structure of discrete control systems.	*2*
2. Sampler and hold elements.	*2*
3. Direct and inverse Z transformation, difference equations.	*2*
4. Discrete transfer function.	*2*
5. Block-diagram algebra.	*2*
6. Steady state errors in discrete control systems.	*2*
7. Basic stability condition.	*2*
8. Bi-linear transformation, use of stability criteria designated for linear continuous control systems.	*2*
9. Jury stability criterion.	*2*
10. Synthesis of discrete control systems.	*2*
11. Description of continuous and discrete control systems with use of space methods.	*2*
12. Stability, controllability and observability.	*2*
B. NON-LINEAR CONTROL SYSTEMS.	
1. Introduction to non-linear control systems. Typical non-linearities in non-linear control systems.	*2*
2. Analysis of non-linear control systems: *– method of describing function,* *– method of phase-plane trajectories.*	*2*
3. Non-linear control systems stability analysis with use of Liapunow methods.	*2*

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:

1. Analysis methods for linear continuous control systems.
2. Analogue compensation of linear continuous control systems.
3. Investigation of industrial controllers.
4. Modelling of control systems with use of MATLAB package.
5. Direct digital control.
6. Synthesis and analysis of combinatorial and sequential logic circuits.
7. Control of electric motor with use of PLC.
8. Investigation of linear discrete control systems.
9. Digital compensation.
10. Analysis of non-linear control systems.
11. Microprocessor sequential controllers.
12. Simulation of control systems – selected topics.

- 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/credition:

* - depending on a system of studies