MODULE DESCRIPTION

Module code	full-time studies:	**Z-ZIP1-E-604**
	part-time studies:	**Z-ZIPN1-E-604**
Module name	**Fundamentals of Automation**	
Module name in Polish	**Podstawy automatyzacji**	
Valid from academic year	**2019/2020**	

MODULE PLACEMENT IN THE SYLLABUS

Field of study	**MANAGEMENT AND PRODUCTION ENGINEERING**
Level of education	**1st degree**
Studies profile	**General**
Form and method of conducting classes	**Full-time and Part-time**
Specialisation	**All**
Unit conducting the module	**The Department of Automatics and Robotics in the Laser Processing Research Centre**
Module co-ordinator	**Marta Grzyb, PhD** **Leszek Płonecki, PhD, DSc**
Approved by:	**Dariusz Bojczuk, PhD, DSc**

MODULE OVERVIEW

Type of subject / group of subjects	**Major**
Module status	**Compulsory**
Language of conducting classes	**English**
Module placement in the syllabus - semester	**Semester VI**
Initial requirements	**No requirements**
Examination (YES/NO)	**YES**
Number of ECTS credit points	**4**

Method of conducting classes		**Lecture**	**Classes**	**Laboratory**	**Project**	**Other**
Per semester	full-time studies:	**30**	**15**			
	part-time studies:	**18**	**9**			

TEACHING RESULTS AND THE METHODS OF ASSESSING TEACHING RESULTS

Category	Symbol	Learning outcomes	Assignations to the directional learning outcomes
Knowledge	W01	A student knows basic principles of automation systems, the principles of their work, and usefulness of their application.	ZIP1_W11
	W02	A student has an advanced knowledge as regards the principles of modelling simple mechanical, electric, and fluid systems.	ZIP1_W01 ZIP1_W02 ZIP1_W04 ZIP1_W11
	W03	A student has an advanced knowledge as regards the elements and systems of automatics in a time domain.	ZIP1_W01 ZIP1_W11
	W04	A student has an advanced knowledge as regards automatics elements and systems in a frequency domain.	ZIP1_W01 ZIP1_W11
	W05	A student has knowledge as regards algebra of block diagrams.	ZIP1_W11
	W06	A student has an advanced knowledge connected with examining stability and quality assessment concerning automated regulation.	ZIP1_W01 ZIP1_W11
	W07	A student has knowledge as regards the analysis and synthesis of automation systems.	ZIP1_W11
Skills	U01	A student is able to determine transmittance of a simple physical model.	ZIP1_W11 ZIP1_U03
	U02	A student is able to utilise Laplace transformation in analysing automation systems as well as their elements.	ZIP1_W11 ZIP1_U03
	U03	A student is able to determine a system response to a given disturbance.	ZIP1_W11 ZIP1_U03
	U04	A student can determine frequency characteristics of a system.	ZIP1_W11 ZIP1_U03
	U05	A student can determine system substitution transmittance.	ZIP1_W11 ZIP1_U03
	U06	A student is able to examine system stability and determine the values of quality indicators of the automation system.	ZIP1_W11 ZIP1_U03
Social competences	K01	A student is aware of the influence of applying automation system on the development of production engineering.	ZIP1_W11 ZIP1_U15
	K02	A student understands the necessity of continuous improvement of his/her knowledge as regards automation systems with reference to their dynamic development.	ZIP1_K01 ZIP1_U06

TEACHING CONTENTS

Method of conducting classes	Teaching contents
Lecture	Introduction. Basic notions appearing in automatics; general schemata of the automation system and the classification of automation systems; examples of automated systems. The description of elements and linear systems. Laplace transformation, operator transmittance and transmittance matrix; system description using state coordinates, determining static characteristics and response to a particular input function from operator transmittance Static and dynamic properties of basic linear elements: proportional first-order, integral, differential, oscillatory, and retarding as well as their examples. Block diagrams algebra. Basic connections, block diagrams transformation, and the methods of determining substitution transmittance of complex systems. Forming block diagrams on the basis of the physical schemata. Determining and initial transmittance analysis. Frequency characteristics. Spectral transmittance, the types of characteristics, frequency characteristics of basic elements, logarithmic characteristics for serial connection, and basic methods of experimental determining frequency characteristics. Characteristics of typical regulation objects. Static and astatic objects as well as their step and frequency characteristics; sample objects; experimental determining static, step, and frequency objects. PID controllers. Structures, characteristics of PID-2 controllers. Stability of linear automation systems. General conditions of stability, stability criteria: Hurwitz, Nyquist for amplitude-phase and logarithmic characteristics. The quality of automation systems. Static accuracy, quality indicators of time courses; indicators concerning frequency characteristics; integral quality indicators. The selected issues of linear syntheses concerning automation systems. Choosing controller types, the selection of controller settings according to principal features of the transient process, and the Ziegler-Nichols method. On-off control systems. Characteristics of controllers, the courses in constant-value control systems; correction of on-off controllers.
Classes	Determining equations of automatics elements. Laplace transformation. Determining responses of systems to a given input function. Block diagrams algebra. Frequency characteristics. The stability of linear systems. Quality assessment of automation systems

METODS OF ASSESSING TEACHING RESULTS

Symbol	Methods of checking the learning outcomes *(select X)*					
	Oral exam	Written exam	Test	Project	Statement	Other
W01		X				
W02		X				
W03		X				
W04		X				
W05		X				
W06		X				
W07		X				
U01			X			

U02			X			
U03			X			
U04			X			
U05			X			
U06			X			
K01						X
K02						X

FORM AND CONDITIONS OF PASSING

Form of classes	Form of credit	Passing conditions
Lecture	Exam	Obtaining at least 50% of the exam points.
Classes	Credit with grade	Written tests in each class, the assessment of exercises is an average grade. Written test at the end of the exercises for students with an average of less than the minimum (50%) allowing them to pass them and giving the opportunity to raise the grade for the exercises.

STUDENT WORKLOAD

Balance of ECTS points												
No.	Type of student's activity	Student's workload										Unit
		full-time					part-time					
1.	Participation in the activities	Lc	C	Lb	P	O	Lc	C	Lb	P	O	h
		30	15				18	9				
2.	Other (consultation, exam)	4	2				4	2				h
3.	**Number of hours of a student's assisted work**	**51**					**33**					h
4.	**Number of ECTS credit points which are allocated for assisted work**	**2,0**					**1,3**					ECTS
5.	**Number of hours of a student's unassisted work**	**49**					**67**					h
6.	**Number of ECTS credit points which a student receives for unassisted work**	**2,0**					**2,7**					ECTS
7.	**Work input connected with practical classes**	**33**					**33**					h
8.	**Number of ECTS credit points which a student receives for practical classes**	**1,3**					**1,3**					ECTS
9.	**Total number of hours of a student's work**	**100**					**100**					h
10.	**Punkty ECTS za moduł** *1 ECTS=25 hours*	**4**										ECTS

LITERATURE

1. Astrom K., Murray R. (2008). *Feedback Systems. An Introduction for Scientists and Engineers*, Princeton University Press (Available online).
2. Getachew M. (2008), *Fundamentals of Automation Technology,* Festo Didactic GmbH & Co.KG (Available online).
3. Not S.Y. (ed.) (2009), *Springer Handbook of Automation*, Springer-Verlag Berlin Heidelberg (Available online).
4. Shell R.L., Hall E.L. (eds.) (2000), *Handbook of Industrial Automation,* Marcel Dekker, Inc. (Available online).