Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

Annex9
to the Rector's Ordinance No. 35/19
of 12 June 2019

COURSE SPECIFICATION

Course code	**M#1-S1-ME-407**
Course title in Polish	**Podstawy automatyki**
Course title in English	**Fundamentals of Control Engineering**
Valid from (academic year)	**2019/2020**

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time**
Specialism	**all**
Department responsible	**Department of Manufacturing Engineering and Metrology**
Course leader	**dr hab. inż. Leszek Płonecki, prof. PŚk.**
Approved by	

COURSE OVERVIEW

Course type	**basic**
Course status	**compulsory**
Language of instruction	English
Semester of delivery	**semester 4**
Pre-requisites	**None**
Examination required (YES/NO)	YES
ECTS value	**5**

Mode of instruction	**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	**15**	**15**	**15**		

LEARNING OUTCOMES

Category of outcome	Out-come code	Course learning outcomes:	Corresponding programme outcome code
Knowledge	W01	have a basic knowledge of types of automation systems, the principles of their operation and the purposefulness of their use.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W02	have knowledge of principles of modelling simple mechanical, electrical and fluid systems.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W03	have knowledge of time-domain analysis of auto-mation components and systems.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W04	have knowledge of analysis of automation compo-nents and systems in the frequency domain.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W05	have knowledge of algebra of blocks diagram.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W06	have knowledge related to stability testing and quality assessment of automatic control systems.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W07	have a basic knowledge of analysis and synthesis of automation systems.	MiBM1_W01 MiBM1_W06 MiBM1_W23
	W08	have a basic knowledge of the measurement meth-ods used.	MiBM1_W01 MiBM1_W06 MiBM1_W12 MiBM1_W23
	W09	have knowledge of simulation tests of automation systems.	MiBM1_W01 MiBM1_W06 MiBM1_W23
Skills	U01	have the skills to determine the transmittance of a simple system based on a physical model.	MiBM1_U01 MiBM1_U07
	U02	have the skills to use Laplace transformation in the analysis of automation elements and systems.	MiBM1_U01 MiBM1_U07
	U03	have the skills to determine the response of the system to a given disturbance.	MiBM1_U01 MiBM1_U07
	U04	have the skills to determine the frequency charac-teristics of the system.	MiBM1_U01 MiBM1_U07
	U05	have the skills to determine the equivalent transmit-tance of the system.	MiBM1_U01 MiBM1_U07
	U06	have the skills to test the stability of the system and determine the values of quality indicators of the automation system.	MiBM1_U01 MiBM1_U07
	U07	have the skills to build a simulation model of an element or an automation system.	MiBM1_U01 MiBM1_U07

	U08	have the skills to experimentally determine the response of the system to a given disturbance.	**MiBM1_U01** **MiBM1_U07** **MiBM1_U12**
	U09	have the skills to synthesize an automation system using basic methods.	**MiBM1_U01** **MiBM1_U07**
Competence	K01	understands the need for constant replenishment of knowledge in the field of automation systems due to their dynamic development.	**MiBM1_K01–MiBM1_K06**
	K02	be aware of the impact of the use of automation systems on the development of production engineering.	**MiBM1_K01–MiBM1_K06**
	K03	understands the need for constant replenishment of knowledge in the field of automation systems due to their dynamic development.	**MiBM1_K01–MiBM1_K06**

COURSE CONTENT

Type of instruction*	Topics covered
lecture	Basic concepts in automation, general automation system diagrams and classification of automation systems, examples of automation systems. Description of linear elements and systems. Laplace transforms, operator transmittance and transmittance matrix, system description using state coordinates, determination of static characteristics and response to a given excitation from operator transmittance Static and dynamic properties of basic linear elements: proportional, order, integrating, differentiating, oscillating and delaying, and examples thereof. Block diagram algebra. Basic connections, the transformation of block diagrams, methods for determining the transfer function of complex systems. Laying block diagrams based on their physical diagrams. Determination and initial analysis of transmittance. Frequency characteristics. Spectral transmittance, types of characteristics, frequency characteristics of basic elements, logarithmic characteristics for serial connection, basic methods of experimental determination of frequency characteristics. Frequency characteristics. Spectral transmittance, types of characteristics, frequency characteristics of basic elements, logarithmic characteristics for serial connection, basic methods of experimental determination of frequency characteristics. Characteristics of typical control objects. Static and astatic object and their step and frequency characteristics, examples of objects, experimental determination of static, step and frequency characteristics of objects. PID regulators. Structures and characteristics of PID controllers. Stability of linear automation systems. General conditions of stability, stability criteria: Hurwitz, Nyquist for amplitude-phase and logarithmic characteristics. Quality of automation systems. Static accuracy, quality indicators of time waveforms, indicators of frequency characteristics, integral quality indicators. Selected problems of the synthesis of linear automation systems. Selection of the type of controller, selection of the controller settings according to the essential features of the transient waveform, the Ziegler-Nichols method. Two-point control systems. Characteristics of regulators, waveforms in the constant value control system, correction of two-position regulators.
class	Determination of equations of automation elements. Laplace transformation. Determining the responses of systems to given extortion. Algebra of blocks diagrams. Frequency characteristics. Stability of linear systems. Assessment of the quality of automation systems

laboratory	Getting to know the possibilities of the MATLAB / SIMULINK environment used for the analysis and synthesis of control systems. Determination of time characteristics of basic dynamic objects. Determination of frequency characteristics of basic dynamic objects. Simulation test of PID controller. Parameters identification of control object. Testing of linear and angular position transducers. Testing the automatic temperature control system. Examination of the two-point control system.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	**Written examination**	**Test**	**Project**	**Report**	**Other**
W01-W09		X				
U01-U09			X		X	
K01-K04						X

ASSESSMENT TYPE AND CRITERIA

Mode of instruction*	Assessment type	Assessment criteria
lecture	**examination assessment**	*The pass mark is a minimum of 50 points out of a possible 100 for the examination.*
class	non-examination assessment	*The pass mark is a minimum of 50% for all the in-class tests.*
laboratory	non-examination assessment	*Regular class attendance.A pass mark for each post-lab report. A minimum of 50 points out of a possible 100 for the final in-class test.*

OVERALL STUDENT WORKLOAD

ECTSweighting							
	Activity type	**Student workload**					**Unit**
1.	Scheduled contact hours	L	C	Lab	P	S	h
		15	15	15			
2.	Other contact hours (office hours, examination)	4	2	2			h
3.	**Total number of contact hours**	**53**					h
4.	**Number of ECTS credits for contact hours**	**1**					ECTS
5.	**Number of independent study hours**	**71**					h
6.	**Number of ECTS credits for independent study hours**	**9**					ECTS
7.	**Number of practical hours**	**83**					h
8.	**Number of ECTS credits for practical hours**	**3,3**					ECTS

9.	**Total study time**	**125**	h
10.	**ECTS credits for the course** *1 ECTS credit =25-30 hours of study time*	**5**	ECTS

READING LIST

1. Norman S. Nise, Control Systems Engineering, John Wiley & Sons, Inc, 2011
2. Dindorf R. Woś P., Development of hydraulic power systems, Kielce, 2016.
3. Dindorf R., Takosoglu J., Woś P., Development of pneumatic control systems, Kielce, 2017.