Załącznik nr 9
do Zarządzenia Rektora PŚk Nr 35/19
w brzmieniu ustalonym Zarządzeniem Nr 12/22

COURSE DESCRIPTION

Course code	full-time studies	**E-I-EN-03-s3**
	part-time-studies	
Course name	**Systemy dynamiczne**	
Course name in English	**Dynamic Systems**	
Valid from academic year	**2022/23**	

PLACEMENT IN THE TEACHING PROGRAM

Field of study	**Computer Science**
Level of education	**1st degree**
Studies profile	**General**
Form and method of teaching classes	**Full-time and part-time studies**
Specialization	**All specializations / Information systems / Computer graphics / Information and communication technology**
Organizational unit responsible for the course	**The Department of Applied Computer Science**
Course coordinator	**Katarzyna Rutczyńska-Wdowiak, PhD, Eng.**
Approved by	**Dean of the Faculty of Electrical Engineering, Automatic Control and Computer Science Roman Deniziak, KUT prof., DSc, PhD**

GENERAL CHARACTERISTIC OF THE COURSE

Course affiliation		**Major**
Course status		**Compulsory**
Language		**English**
Semester	full-time studies	**III**
	part-time-studies	**IV**
Requirements		**Mathematics**
Exam (YES/NO)		**No**
ECTS		**2**

Course form		**lecture**	**classes**	**laboratory**	**project**	**other**
Hours per semester	full-time studies	**15**		**15**		
	part-time-studies	**9**		**9**		

LEARNING RESULTS

Category	Result Symbol	Learning Results	References to the field of study results
Knowledge	W01	A student has knowledge as regards theoretical fundamentals of continuous and discrete dynamical systems.	INF_W16
	W02	A student has knowledge as regards a mathematical description and state space of continuous and discrete dynamical systems.	INF_W16
	W03	A student has knowledge as regards the methods of examining the stability of continuous and discrete dynamical systems.	INF_W16
	W04	A student has knowledge of classical and numerical methods of dynamic systems control.	INF_W16
Skills	U01	A student can: analyse the phenomena taking place in dynamical systems, describe them with mathematical relationships, determine time waveforms of basic values of these systems, and make appropriate calculations.	INF_U16
	U02	A student can: apply appropriate analytical and simulation methods to solve the issue of dynamical systems analysis, analyse the results and draw appropriate conclusions.	INF_U16
Social competence	K01	A student is aware of the impact of technological solutions on the environment and understands the non-technical aspects and effects of these activities.	INF_K1 INF_K2
	K02	A student is aware of rapid progress of knowledge (as regards the methods and technologies of theoretical and simulation analysis) and understands the necessity of continuous education.	INF_K1 INF_K2

COURSE CONTENT

Course Form	Content
lecture	1. Theoretical fundamentals of continuous dynamical systems. Theoretical fundamentals of discrete dynamical systems. 3. Description methods of continuous and discrete systems in state space. Algebraic criteria of stability. 4. Bellman dynamic programming in dynamic systems. 5. Selected methods of artificial intelligence used in control problems (part 1). 6. Selected methods of artificial intelligence used in control problems (part 2). 7. Classical and numerical methods in control problems. 8. Obtaining a credit for the lectures.
laboratory	1. Introduction. 2. Description of a continuous system in the state space. Analysis of stability. 3. Bellman dynamic programming in dynamic systems. 4. Modeling a selected control problem with the use of a genetic or evolutionary algorithm. 5. Selection of control parameters of the genetic / evolutionary algorithm in the control problem of dynamic systems. 6. Selected numerical methods in a control problem (part 1). 7. Selected numerical methods in a control problem (part 2). 8. Obtaining a credit for laboratory classes

LEARNING RESULTS VERIFICATION METHODS

Result Symbol	Learning results verification methods					
	Oral Exam	Written Exam	Midterm	Project	Report	Other
W01			X			
W02			X			
W03			X			
W04			X			
U01			X		X	
U02			X		X	
K01			X		X	
K02			X		X	

ASSESSMENT FORMS AND CRITERIA

Course Form	Assessment Form	Assessment Criteria
lecture	obtaining a credit for the lectures	Obtaining at least 50% of test points during the class.
laboratory	obtaining a credit for laboratory classes	Obtaining at least 50% of the points from tests and reports during classes

STUDENT'S VOLUME OF WORK

ECTS Balance												
No.	Activity Type	Student Involvement										Unit
		full-time studies					part-time-studies					
1.	Participation in classes according to the schedule	Lec	C	Lab	P	S	Lec	C	Lab	P	S	h
		15		15			9		9			
2.	Other (consultations, exams)	4		4			2		2			h
3.	**Total with the direct assist of an academic teacher**	**38**					**22**					h
4.	**Number of ECTS, that students obtains with the direct assist of an academic teacher**	**1,52**					**0,88**					ECTS
5.	**Hours of unassisted student work**	**12**					**28**					h
6.	**Number of ECTS that student obtains working unassisted**	**0,48**					**1,12**					ECTS
7.	**Practical classes volume of work**	**15**					**9**					h
8.	**Number of ECTS obtained by student at practical classes**	**0,79**					**0,82**					ECTS
9.	**Total student's volume of work expressed in hours**	**50**					**50**					h
10.	**ECTS**	**2**										ECTS

BIBLIOGRAPHY

1. Stefański T .: Theory of control, vol. I, Linear systems. Script of Kielce University of Technology, No. 367, Kielce 2002.
2. Stefański T .: Theory of control, vol. II. Script of Kielce University of Technology, No. 365, Kielce 2002.
3. Michalewicz Zb .: Genetic algorithms + data structures = Evolutionary programs. Springer-Verlag and Heidelberg GmbH&Co. KG, 2011.
4. Rutkowski L .: Methods and techniques of artificial intelligence. Polish Scientific Publishers PWN 2009.