Module/Subject Syllabus Summary
[Mechanical Engineering]
Studies …

Subject:	*Switching systems*
Subject type:	*Additional*
Subject code:	*0*
Year:	*IV*
Semester:	*8*
Form of studies:	*Full-time course*
Type of classes and hours per semester:	
Lecture	*30*
Exercise	
Laboratory practice	
Project	*30*
ECTS points:	*0*
Form of credit:	*Examination/assessment*
Lecture language:	*English*

Subject objective	
C1	Provide knowledge of the basics of automatic control systems which use bistable switching circuits
C2	To acquaint students with the basics of mathematical logic and pneumatic diverting valves based on this knowledge.

Prerequisites in knowledge, skills and other competencies	
1	Mathematics – basics of logic, pneumatics and hydraulics
2	Physics, mechanics

Educational effects	
	Knowledge:
EK 1	*Student* knows and understands the term and meaning of automatic control systems
EK 2	Student is able to examine and assess the logic of automatic control systems
	Skills:
EK 3	Student analyzes the properties of switching control systems
EK 4	Student is able to determine and build logic control system
	Social competencies:
EK 5	Student maintains cautious in expressing an opinion on the tested automatic control system
EK 6	Student maintains openness to cooperation in the collective

Curriculum content of Subject	
Form of classes – Lecture	
	Curriculum content
W1	Positional number systems and numeric codes in terms of their application to switching systems.
W2	Boolean algebra and logic functions. Ways of presenting logical functions.
W3	Minimization of Boolean functions using Karnaugh maps.
W4	Logical functors and construction of diagrams of control systems using the logic gates
W5	The technological process as a control object. Determination of models of control systems using the logical functions.
W6	Diverting valves, their construction and operation.
W7	*Examples of control implementation using diverting valves*
W8	Selected technological process with use of control valves.
Form of classes– Exercise	
	Curriculum content
ĆW1	
ĆW2	
ĆW…	
Class form: laboratory practice	
	Curriculum content
L1	
L2	
L…	
Form of classes – Project	
	Curriculum content
P1	Conversion of positional numeral systems
P2	Presentation of logical functions in canonical forms
P3	Minimization of functions using the method of Karnaugh Maps
P4	Construction of diagrams for logic functions using gates - NOR or NAND only
P5	Construction of diagrams for logic functions using two-position and three-way valves
P6	*Control of selected technological process using diverting valves*
P7	Example of realization of gearboxes production control.
P8	*Control system for choosing gearbox components – assessment of self-made project*

Teaching methodology	
1	Informative lecture with multimedia presentations
2	Exercises based on the analysis of logic circuits
3	Classes based on observation and analysis, activating method related to practical students action in order to solve a given problem

Student workload	
Form of activity	Average hours to complete activity
Teacher contact hours, including:	
….	
…	
Total student work time, including:	
…	
…	
Total student work time	
Total ECTS for the subject:	
Total of ECTS for practical classes (exercise, laboratory practice, projects)	

Basic reference literature	
1	*Węsierski Ł., Maślanka T., Matwijszyn J.: "Zbiór zadań z Projectowania przełączających układów automatyki" Skrypty uczelniane AGH Kraków 1971*
2	*Holejko D., Kościelny W., Niewczas W.: Zbiór zadań z podstaw automatyki. Wyd. Politechniki Warszawskiej Warszawa 1985*
3	*Kościelny W.: Materiały pomocnicze do nauczania podstaw automatyki. Oficyna Wydawnicza PW,Warszawa 2001, wyd. III*
Complementary reference literature	
1	*Takahashi Y.,RabinsM.J.,Auslander D.M.: Sterowanie i systemy dynamiczne. Wyd.Naukowo-Techniczne, Warszawa 1976*
2	*Craig J. J.: Wprowadzenie do robotyki, WNT, Warszawa, 1995*

Educational effect matrix					
Educational effect	Specific educational effect reference to curriculum-wide effects (PEK)	Subject objective	Curriculum content	Teaching methodology	Evaluation methods
EK 1	MBM1A_U16+ + MBM1A_U11+ +	*C1, C2*	*[W1, W3, W4, W5]*	*[1, 2]*	*[O1, O2]*
EK 2	MBM1A_U16+ + MBM1A_U11+ +	*C1*	*[W5, W6]*	*[1,2,3]*	*[O3]*
EK 3	MBM1A_U16+	*C1, C2*	*[W1, W2,*	*[2, 3]*	*[O1,O2]*

	+ MBM1A_U11+ +		*W7,P3]*		
EK4	MBM1A_K01+ + MBM1A_K07+ +	*C1, C2*	*[W1 - 7]*	*[1,2,3]*	*[O3]*

Evaluation methods and criteria		
Evaluation method symbol	Evaluation method description	Pass threshold
O1	*Written lecture and exercise assessment*	*50%*
O2	*Examination*	*60%*
O3	*Project reports*	*100%*

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