

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Teoria automatów**  
 Name in English: **Theory of automata**  
 Main field of study (if applicable): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **optional**  
 Subject code: **ARR042106**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		30		
Number of hours of total student workload (CNPS):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. relating to knowledge: Knowledge of basic digital circuits. relating to skills: Knowledge of the practical implementation and verification of simple digital circuits. relating to social competencies: Ability of creative thinking and working. Ability of team working.

**SUBJECT OBJECTIVES**

- C1. Knowledge of the most popular medium-scale digital systems integration, such as: adders, comparators, counters, registers, multiplexers, demultiplexers, code converters.  
 C2. Acquisition of theoretical and practical knowledge of combinational logic circuits: canonical form, Karnaugh map, the Quine-McCluskey algorithm, the hazard phenomenon.  
 C3. Acquisition of theoretical and practical knowledge of sequential asynchronous logic circuits: the method of consecutive switching tables, Moore and Mealy type automata, the race phenomenon.  
 C4. Acquisition of theoretical and practical knowledge of sequential synchronous logic circuits.  
 C5. Familiarization with methods concerning: presenting a logic circuit operation, selecting of design methods, practical analysis/synthesis methods and ways of implementing logic circuits. Ability of practical team working

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 Student has a knowledge of the architecture and operating the most popular medium-scale digital systems integration.  
 PEK\_W02 Student has a knowledge of operating and analysis/synthesis methods of combinational logic circuits.  
 PEK\_W03 Student has a knowledge of operating and analysis/synthesis methods of sequential (synchronous and a synchronous) logic circuits.

*relating to skills:*

- PEK\_U01 Student has the ability of practical use the most popular medium-scale digital systems integration.  
 PEK\_U02 Student is able to conduct both analysis and synthesis, as well as to implement combinational logic circuits with use the optimization methods, with eliminating a hazard phenomenon.  
 PEK\_U03 Student is able to conduct both analysis and synthesis, as well as to implement asynchronous (with eliminating of race phenomenon) and synchronous logic circuits with use the optimization methods.

*relating to social competences:*

- PEK\_K01 Student can competently act alone and cooperate in the team that develops a complex engineering project.

## PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Introduction. Establishing of conditions for passing the course. Basics of Boole algebra. Typical logic gates and circuits and their graphic symbols. Canonical forms of switching function, the principles of minimization.	2
Lec 2	Design of combinational logic circuits - the Karnaugh maps method. Eliminating a hazard phenomenon. Design of combinational logic circuits with use of the multiplexer.	2
Lec 3	Design of combinational logic circuits - Quine-McCluskey algorithm.	2
Lec 4	Sequential automata - types, general characteristic, memory implementation methods. The rules of sequential automata design with use of the method of consecutive switching tables.	2
Lec 5	Sequential automata - description of Moore and Mealy type automata, time diagrams, switching and output tables, graphs.	2
Lec 6	Sequential asynchronous automata - design examples with use of the method of consecutive switching tables. Eliminating a hazard phenomenon.	2
Lec 7	Sequential synchronous automata - design steps.	2
Lec 8	Qualified test.	1
Total hours:		<b>15</b>

Form of classes - laboratory		Number of hours:
Lab 1	Presentation of the Rules of Procedure Health and Safety Laboratory. Establish rules for passing. General knowledge of the laboratory stand: educational models, simulation program.	2
Lab 2	Basic systems of gates and flip-flops - implementation with use of educational models and simulation program.	2
Lab 3	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of gates.	2
Lab 4	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of gates. (continued)	2
Lab 5	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of flip-flops.	2
Lab 6	Sequential asynchronous automata design with use of the method of consecutive switching tables.	2
Lab 7	Sequential asynchronous automata design with use of the method of consecutive switching tables. (continued)	2
Lab 8	Multiplexers, demultiplexers.	2
Lab 9	Code converters.	2
Lab 10	Sequential synchronous automata design.	2
Lab 11	Sequential synchronous automata design. (continued)	2
Lab 12	Adders, comparators.	2
Lab 13	Registers.	2
Lab 14	Asynchronous and synchronous counters.	2
Lab 15	Additional classes.	2
Total hours:		<b>30</b>

## TEACHING TOOLS USED

- N1. Informative lecture.
- N2. Educational models of digital circuits.
- N3. Program for simulating digital circuits.
- N4. Project report.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02 PEK_W03	attendance on classes
F2(w)	PEK_W01 PEK_W02 PEK_W03	final test
P(w)	$P=0,1F1+0,9F2$	
F1(L)	PEK_U01 PEK_U02 PEK_U03	activity
F2(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	laboratory report
P(L)	$P = 0,3F1 + 0,7F2$	

PRIMARY AND SECONDARY LITERATURE
<p><b>PRIMARY LITERATURE:</b></p> <p>[1] Układy logiczne. Ćwiczenia laboratoryjne. Skrypt Politechniki Wrocławskiej pod red. Mirosława Łukowicza. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2002.</p> <p><b>SECONDARY LITERATURE:</b></p> <p>[1] Wilkinson B., Układy cyfrowe. WKŁ, Warszawa 2000.  [2] Skorupski A., Podstawy techniki cyfrowej. WKŁ, Warszawa 2001.  [3] Kamionka-Mikuła H., Małysiak H., Pochopień B., Układy cyfrowe. Teoria i przykłady. Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego. Wydanie III poszerzone. Gliwice 2001.  [4] Majewski W., Układy logiczne. WNT, Warszawa 1993.</p>

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
ARR042106 - Theory of automata  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY Control Engineering and Robotics**

<b>Subject educational effect</b>	<b>Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)</b>	<b>Subject objectives</b>	<b>Programme content</b>	<b>Teaching tool number</b>
PEK_W01	K1AIR_ASE_W04	C.1 C.5	Lec1	N.1
PEK_W02	K1AIR_ASE_W04	C.2 C.5	Lec1 Lec2 Lec3 Lec8	N.1
PEK_W03	K1AIR_ASE_W04	C.3 C.4 C.5	Lec4 Lec5 Lec6 Lec7 Lec8	N.1
PEK_U01	K1AIR_ASE_U04	C.1 C.5	Lab1 Lab2 Lab8 Lab9 Lab12 Lab13 Lab14	N.2 N.3 N.4
PEK_U02	K1AIR_ASE_U04	C.2 C.5	Lab1 Lab2 Lab8 Lab9 Lab12	N.2 N.3 N.4
PEK_U03	K1AIR_ASE_U04	C.3 C.4 C.5	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab10 Lab11	N.2 N.3 N.4
PEK_K01	K1AiR_K09	C.5	Lab3 Lab4 Lab5 Lab6 Lab7 Lab10 Lab11 Lab15	N.4