

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Układy logiczne**
 Name in English: **Logic design**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Electrical Power Engineering**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **optional**
 Subject code: **ELR042114**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	60		30		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of basic digital circuits.
2. Knowledge of the practical implementation and verification of simple digital circuits.

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 asynchronous) 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.	2
Lec 2	Canonical forms of switching function, the principles of minimization.	2
Lec 3	Design of combinational logic circuits - the Karnaugh maps method. Eliminating a hazard phenomenon.	2
Lec 4	Design of combinational logic circuits with Quine-McCluskey algorithm (binary and decimal version) and with use of the multiplexer.	2
Lec 5	Design of combinational logic circuits with Quine-McCluskey algorithm (binary and decimal version) and with use of the multiplexer. (continued)	2
Lec 6	The minimizing of ill-defined functions.	2
Lec 7	The minimizing of multi-output functions.	2
Lec 8	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 9	The examples of sequential automata design with use of the method of consecutive switching tables, with the problem of infeasibility switching table.	2
Lec 10	Sequential automata - description of Moore and Mealy type automata, time diagrams, switching and output tables, graphs. The rules of sequential asynchronous automata design with use of the method of switching and output tables.	2
Lec 11	The examples of sequential asynchronous automata design with use of the method of switching and output tables. Eliminating of race phenomenon.	2
Lec 12	Sequential synchronous automata design.	2
Lec 13	Typical switching circuits, principles of design and testing using simulation programmes and educational models.	2
Lec 14	Asynchronous and synchronous counters. Principles of design modulo $\neq 2^n$ binary counters.	2
Lec 15	Shift registers. Principles of operation and design. Code converters. Principles of operation and design.	2
Total hours:		30

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 programme.	1
Lab 2	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of gates.	2
Lab 3	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of gates. (continued)	2
Lab 4	Sequential asynchronous automata design with use of the method of switching and output tables. Implementation with use of flip-flops.	2
Lab 5	Sequential asynchronous automata design with use of the method of consecutive switching tables.	2
Lab 6	Multiplexers, demultiplexers, code converters.	2
Lab 7	Sequential synchronous automata design.	2
Lab 8	Adders, comparators, counters, registers.	2
Total hours:		15

TEACHING TOOLS USED

- N1. Informative lecture.
- N2. Educational models of digital circuits.
- N3. Programme 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 exam
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)	$P = 0,3 F1 + 0,7F2$	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Układy logiczne. Ćwiczenia laboratoryjne. Skrypt Politechniki Wrocławskiej pod red. Mirosława Łukowicza. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2002 SECONDARY LITERATURE: [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

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR042114 - Logic design
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Electrical Power Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	S2EEN_W11	C.1	Lec1 Lec2 Lec13 Lec14 Lec15	N.1
PEK_W02	S2EEN_W11	C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec13	N.1
PEK_W03	S2EEN_W11	C.3 C.4	Lec1 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13	N.1
PEK_U01	S2EEN_U12	C.1 C.5	Lab1 Lab6 Lab8	N.2 N.3 N.4
PEK_U02	S2EEN_U12	C.2 C.5	Lab1 Lab2 Lab3 Lab4 Lab5	N.2 N.3 N.4
PEK_U03	S2EEN_U12	C.3 C.4 C.5	Lab1 Lab2 Lab3 Lab4 Lab5 Lab7	N.2 N.3 N.4
PEK_K01	K2ETK_K02 K2ETK_K06 K2ETK_K07	C.5	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.4