

SYNTHESIS OF DIGITAL SYSTEMS

Faculty of Computer Science			
Study programme:	Computer Science	Degree level:	Engineer's degree full-time programme
Specialization	---	Diploma path:	2026/2027W - 2026/2027S
Module name:	Synthesis of Digital Systems (Synteza układów cyfrowych)		
Module type:	obligatory	Semester: 2	ECTS:5 Module ID:FCS-00106
No. of hrs in semester:	Lecture (L) - 30 Classes(C) - 0 Specialization workshop (SW) - 30 Project (P) - 0 Laboratory classes (LC) - 0 Seminar (S) - 0		
Prerequisites	Discrete Mathematics (FCS-00054),		
Aims and objectives:	Obtained knowledge: Understanding the principles of operation of digital circuits of small and medium-scale integration. Obtained skills: design of simple digital circuits of small, medium and large scale integration.		
Forms of teaching activities::	lecture, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes:
		Written test, reports, short preparation tests	
Module content:	<p>Information processing. Axioms of Boolean algebra. Logic gates NOT, AND, OR, NAND gate. Classification of digital circuits. Combinational circuits. Truth table. Minimization of logic functions. Karnaugh charts. Realisation of the logic function using logic gates. Minimization of functions with Quine-McCluskey method. Race hazard. Design of multi-output circuits. Standard MSI blocks performing Boolean functions: multiplexer, demultiplexer, decoder, ROM, RAM. Synchronous systems. System clocking. Model of Moore and Mealy machine. Table of transitions and outputs. Minimizing the number of states. Synthesis of synchronous circuits. Encoding states. Flip-flops: D, JK, SR and T. Synthesis of synchronous circuits. Functional blocks.</p> <p>Specialist workshop:</p> <ol style="list-style-type: none"> 1. Getting to know MultiSim and Max. 2. Combinational circuits. 3. Iterative systems. 4. Synchronous systems. 7. Complex systems . 		
Teaching methods:	simulation, laboratory exercises, informative lecture,		
Learning outcomes			
Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge – skills – competence. Each learning outcome must be verifiable	Reference to the programme learning outcomes of education	
L01	knows the principles of operation of digital circuits		
L03	knows and understands the processes of designing and manufacturing digital circuits and microprocessors		
L04	is able to comprehensively compare the technologies of production and design solutions of digital circuits and computer technology devices		
L05	can design and test a simple digital circuit		
L06	is able to formulate a specification of the digital system for a specific application		
No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed	
L01	Written test	L	
L03	short tests	SW	
L04	Written test	L	
L05	report	SW	
L06	report	SW	
Student's workload (in hours)	1 - Attendance at lectures	None	30
	2 - Attendance at specialistic workshop	None	30
	3 - Preparation for specialistic workshop	None	15
	4 - Preparation of reports	None	30
	5 - Preparation for exam	None	20
	TOTAL:		125
Quantitative indicators	Student's workload - activities that require direct teacher participation: (1)+(2)	60	ECTS 2.4
	Student's workload connected with practical classes (2)+(3)+(4)	75	3.0
Basic references:	<ol style="list-style-type: none"> 1. John F. Wakerly; Digital Design, Principles and Practices, (4th Edition), Pearson/Prentice Hall, 2005. 2. M. Morris Mano, Michael D. Ciletti; Digital Design (4th Edition), Prentice Hall, 2006. 		
Further reading			

1. Russell G. Tessier, Digital System Design, <http://www.ecs.umass.edu/ece/tessier/courses/221>
2. Jeff Jackson, ECE380 Digital Logic; <http://jjackson.eng.ua.edu/courses/ece380/lectures>
3. All about circuits; vol. IV, http://www.allaboutcircuits.com/vol_4/index.html

Unit:	Department of Digital Media and Computer Graphics	Lecturer/ instructor	dr inż. Wiktor Jakowluk
Date of issuing the programme:	31st March 2026	Author of the programme:	dr inż. Wiktor Jakowluk

L - lecture, C - classes, LC - laboratory classes, P-project, SW - specialization workshop, S - seminar