

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Computer Science
1.4 Field of study	Computers and Information Technology
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Information Engineering

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	Analiza și sinteza circuitelor (ro) Analysis and Synthesis of Circuits (en)						
2.2 Course coordinator	Lect. dr. eng. Ion-Cornel Mitulețu – ion.mituletu@ubbcluj.ro						
2.3 Seminar coordinator	<i>To be nominated</i>						
2.4. Year of study	3	2.5 Semester	6	2.6. Type of evaluation	C	2.7 Type of discipline	Optional DS
2.8 Code of the discipline	MLE5185						

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2 LP
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					16
Additional documentation (in libraries, on electronic platforms, field documentation)					11
Preparation for seminars/labs, homework, papers, portfolios and essays					11
Tutorship					0
Evaluations					6
Other activities:					0
3.7 Total individual study hours			44		
3.8 Total hours per semester			100		
3.9 Number of ECTS credits			4		

4. Prerequisites (if necessary)

4.1. curriculum	• N/A
4.2. competencies	• Mathematics (Algebra), Physics (electricity)

5. Conditions (if necessary)

5.1. for the course	• A minimum of 80% course attendance rate is mandatory for being admitted to the final exam
5.2. for the seminar /lab activities	• Preliminary preparation of summaries from the indicated bibliography (laboratory textbook)

6. Specific competencies acquired

Professional competencies	<p>C5 Use of the basic concepts of electronic devices, circuits and instrumentation</p> <p>C5.1 Appropriate use of the operating principles of electronic devices and circuits, as well as methods of measuring electrical quantities</p> <p>C5.2 Analysing, designing, executing and measuring of electronic circuits of low/ medium complexity</p> <p>C5.3 Diagnosis / troubleshooting of electronic circuits and instruments</p> <p>C5.4 Use of electronic tools to characterize and evaluate the performance of electronic circuits</p> <p>C5.5 Designing electronic circuits of low / medium complexity and implementing them using CAD techniques</p>
Transversal competencies	<p>CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation</p> <p>CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge</p>

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	<ul style="list-style-type: none"> The main objective of this discipline is to give to the students the bases of the Analysis and Synthesis of Circuits, in order to make them able to analyze, design and implement any digital system.
7.2 Specific objective of the discipline	<p>To reach this goal, students will learn to:</p> <ul style="list-style-type: none"> Analyze and synthesize combinational logic systems; Analyze and synthesize synchronous and asynchronous sequential machines; Apply digital system design principles and descriptive techniques; Utilize programmable devices such as FPGAs and PLDs to implement digital systems; Understand timing issues in digital systems and study these via digital circuit simulation.

8. Content

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction. Number systems and codes, errors	Online presentations, discussions (face to face or using TEAMS platform, if necessary)	N/A
2	Number representation systems. Binary arithmetic		
3	Boolean Algebra. Boolean functions. Logic gates. Digital systems and functions representation		
4	Methods for minimizing Boolean functions and systems of functions		
5	Combinational logic circuits (CLCs) analysis and design (synthesis). SSI and MSI CLCs.		
6	Methods for designing digital systems with SSI, MSI, LSI and VLSI		

	circuits. Combinational Hazard.		
7	Sequential logic circuits. Latches and Flip-Flops.		
8	Flip-Flops applications: frequency dividers, counters		
9	Flip-Flops applications: data registers, converters, memories		
10	Methods for designing digital systems using Flip-Flops		
11	Methods for designing digital systems using memories, multiplexers, decoders, counters		
12	Methods for designing sequential synchronous systems		
13	Methods for designing digital systems using programmable devices (I)		
14	Methods for designing digital systems using programmable devices (II)		
Bibliography			
1. Contemporary Logic Design, Randy H. Katz, Benjamin Cunnings / Addison Wesley Publishing Co., 1993.			
2. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.			
3. FPGA-based System Design, Wayne Wolf, PRENTICE HALL Professional Technical Reference Upper Saddle River, NJ 07458 www.phptr.com ISBN: 0-13-142461-0.			
4. Digital Notes on Digital Logic Design-B.Tech Ii Year - I Sem (2018-19)- Department of Information Technology-Malla Reddy College of Engineering & Technology - https://mrcet.com/downloads/digital_notes/IT/DIGITAL%20LOGIC%20DESIGN%20(R17A0461).pdf			
5. Digital Electronics and Logic Design Tutorials (2019) - https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/			
6. Loops & Complexity in DIGITAL SYSTEMS-Lecture Notes on Digital Design in Ten Giga-Gate/Chip Era, Gheorghe M. Stefan (v.2022) - http://users.dcae.pub.ro/~gstefan/2ndLevel/teachingMaterials/0-BOOK.pdf			
7. FPGA Design Creation and FPGA Simulation - https://www.aldec.com/en/products/fpga_simulation/active-hdl			
8.2. Applications (Laboratory)		Teaching methods	Notes
1	Basic Logic Circuits	Practical work on test boards, FPGA boards, specialized software, blackboard presentations, supplemental explanations and discussions (face to face or using TEAMS platform, if necessary)	N/A
2	ActiveHDL Schematic Editor and Simulator (I)		
3	ActiveHDL Schematic Editor and Simulator (II)		
4	Combinational Logic Circuits (I)		
5	Combinational Logic Circuits (II) – MSI circuits		
6	Combinational Logic Circuits (III) – Complex circuits		
7	Synthesis of Combinatorial Logic Circuits using Programmable Logic Devices		
8	Flip-flops		
9	Counters (I)		
10	Counters (II)		
11	Registers and Shift Registers		
12	The XILINX FPGA Family		
13	Synthesis of Sequential Logic Circuits using FPGA Devices		
14	Laboratory test		
Bibliography			
1. Analiza și sinteza dispozitivelor numerice, Îndrumător de laborator, Ediția a-3-a, L. Văcariu, O. Creț, A. Neșin, Ed. U.T. Press, Cluj-Napoca, 2009.			
2. Active-HDL 6.1 - https://courses.cs.washington.edu/courses/csep567/04sp/tools/t1.html			

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

Since this discipline is a basic one in Computer Science, its content is “classic” but also modern because it familiarizes students with the modern principles of the Analysis and Synthesis of Circuits (utilization of modern simulation and synthesis tools, FPGA and CPLD-based design etc.). Its contents have been discussed with major academia and industry actors from Romania, Europe and U.S.A. and it has been evaluated several times by Romanian Governmental Agencies like CNEAA and ARACIS.

10. Evaluation

Activity type	10.1	Evaluation criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		Problems solving abilities		Written Exam (face to face or using TEAMS platform, if necessary)		70%
		Presence, (Inter)activity				
Applications		Problems solving abilities		(face to face or using TEAMS platform, if necessary)		30%
		Presence, (Inter)activity				
10.4 Minimum standard of performance						
<ul style="list-style-type: none"> • Conditions for participating in the final Written exam: Applications grade ≥ 5 AND a minimum of 80% course attendance rate; • Conditions for passing the exam: Written exam grade ≥ 5; • Modeling and solving typical Logic Design problems using the domain-specific formal apparatus. 						

Date

May 20, 2022

Signature of course coordinator

Lect. dr. eng. Ion-Cornel Mitulețu



Signature of seminar coordinator

Date of approval

24.05.2022

Head of department
Prof. dr. Laura Dioșan

