SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications and Information Technology
1.3	Department	Bases of Electronics
1.4	Field of study	Electronics and Telecommunications Engineering
1.5	Cycle of study	Bachelor of Science
1.6	Program of study/Qualification	Telecommunications Technologies and Systems/ Engineer, Applied Electronics/ Engineer
1.7	Form of education	Full time
1.8	Subject code	TST-E19.00, EA-E19.00

2. Data about the subject

2.1	Subject name					Digital Integrated Circuits					
2.2	Subject area					Electronic devices and circuits					
2.3	Course responsible/lecturer					Assoc. Prof Mihaela Cîrlugea, Ph.D					
2.4	Teachers in charge of applications					Assoc. Prof Mihaela Cîrlugea, Ph.D					
2.5	Year of study	II	2.6	Semester	1	2.7	Assessment	Exam	2.8	Subject category	DD/DI

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course [hours/week]	Applications [hours/week]			Course [hours/sem.]	Applications [hours/sem.]			Indiv. study	TOTAL	Credits
				S	L	P		S	L	P			
II / 1	Digital Integrated Circuits	14	2	1	1		28	14	14		44	100	4

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	16
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	20
Tutoring	5
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	44
3.8	Total hours per semester	100
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	N / A
4.2	Competence	Bases of numeration, elements of logic and binary algebra Bases of programming

5. Requirements (where appropriate)

5.1	For the course	Amphitheatre, Cluj-Napoca
5.2	For the applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	To distinguish digital from analog circuits, Synchronous and asynchronous circuits, Combinational and sequential digital components Logic algebra notions. Binary codes and base 2 arithmetics. Combinational circuits applications. Decoders, multiplexers, demultiplexers. Internal structures and flip-flop circuits functioning description. Analysis and synthesis of synchronous sequential logic circuits with flip-flops. Sequential automata. Introduction in VHDL language. Synchronous integrated counters. Applications with synchronous integrated counters. Latches and serial shift operations. Sequential automata and communication protocols implemented with sequential synchronous circuits. Asynchronous sequential automata.
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: - develop abilities to process logical expressions and logic function description - to do the transition from the algebraic logic function form to the circuit scheme and vice-versa - to analyze combinational and sequential circuits using truth tables and signal diagrams - to use sequential and combinational logic circuits containing logic gates, multiplexers, demultiplexers, PLA, decoders, flip-flops, counters, registers - to design fundamental combinational and sequential digital systems - to analyze and describe fundamental digital systems using the VHDL language
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, the students will be able to: - use the lab instrumentation (power supply, oscilloscope, function generator, multimeter) for the experimental study of electronic circuits - use the experimental boards - connect the lab instrumentation with the experimental boards, in order to experimentally study electronic circuits - use the computer to the numerical data obtained through the explorations – store and analyze the numerical data obtained through the explorationseasy compute and handle with numbers in 2 and 16 base – sinthesise logic problems of various complexity - design, implement and simulate digital circuits on computer and on digital board
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C2. To apply basic methods for signal acquisition and processing C3. To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques C4. To design, implement and operate data, voice, video and multimedia services, based on the understanding and application of fundamental concepts from the field of communications and information transmission. C5. To select, install, configure and exploit fixed and mobile telecommunications equipment. To equip a site with common telecommunications networks.
Cross competences (Grila1 and Grila2 RNCIS)		N.A.

7. Discipline objectives (as results from the key competences gained)

7.1	General objectives	Developing the competences regarding the use, analysis and (re)design of fundamental electronic circuits.
7.2	Specific objectives	1. Recognizing and understanding basic concepts specific to fundamental electronic circuits. 2. Developing skills and abilities necessary for the use of fundamental digital components and circuits. 3. Developing skills and abilities for the analysis and (re)design of fundamental electronic circuits.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Introduction to the Binary Logic. Numeration systems	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Boolean Algebra. Operations. Properties		
3	Combinational Logic Circuits. . Fundamental logic gates. Analysis and synthesis of circuits containing gates. Logic functions minimization		
4	Function Minimization. Karnaugh Maps. Combinational circuit applications: summer, comparer, coder, parity decoder, etc		
5	Multiplexers. Binary Trees		
6	Demultiplexers. Decoders		
7	Memories and Programmable Logic Arrays Basics		
8	Sequential Logic Circuits. RS, D, JK, T flip-flops. Internal structures and functioning. Analysis and synthesis of sequential synchronous circuits containing flip-flops		
9	Synchronous and Asynchronous Counters with Flip-Flops		
10	Sequential Synchronous Automata with Flip-Flops		
11	Synchronous Counters. Applications with Counters		
12	Circuit applications with registers. Johnson counters. Serial-parallel interfaces, LIFO and FIFO memories		
13	Latches and serial registers		
14	Sequential Synchronous Automata with Counters and Registers		
8.2. Applications		Teaching methods	Notes
Laboratory			
1	Labour protection. Combinational logic circuits implemented with SSI logic modules	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
2	Applications with Multiplexers		
3	Applications with Demultiplexers and Decoders		
4	Applications with Flip-Flops (counters, frequency dividers, signal generators)		
5	Sequential Synchronous Automata with Flip-Flops		
6	Applications with Synchronous Counters (counters, frequency dividers, signal generators)		
7	Sequential Synchronous Automata with Counters		
Seminary			
1	Fundamental logic functions, minimization, logic operations		
2	Analysis and synthesis of circuits containing gates.		
3	Multiplexers and their applications		
4	Decoders and demultiplexers		
5	Analysis and synthesis of circuits with flip-flops (D, T, RS, JK).		
6	Sequential synchronous automata with flip-flops and CLC		
7	Analysis and synthesis of sequential automata with counters		

Bibliography

1. M. Cîrlugea: DIC Course (in progress)
2. S. Hintea, Lelia Feştilă, Mihaela Cîrlugea – Circuite Integrate Digitale.UT Press, 2005.
3. Gabor Csipkes, Doris Csipkes, Sorin Hintea, Mihaela Cîrlugea - "Circuite integrate digitale: culegere de probleme", editura UT Press 2011
4. S. Hintea Proiectarea circuitelor digitale VLSI, Ed. Casa Cărţii de Ştiinţă, 1997.

5. Lelia Feştilă – Electronică digitală- Circuite logice combinaţionale, Lito. UTC-N, 1994.
6. Lelia Feştilă – Electronică digitală - Circuite logice secvenţiale, Lito, UTC-N, 1994.
7. S. Hintea, Lelia Feştilă, Mihaela Cîrlugea – Circuite Integrate Digitale. Culegere de probleme, Ed. Casa Cărţii de Ştiinţă, 1999.
8. Lelia Feştilă, Sorin Hintea – Circuite integrate digitale. Îndrumător de laborator, Ed. Lito UTC-N, 1991
9. Dan Nicula. Electronica digitala. Carte de invatatura. Editura Universităţii TRANSILVANIA din Braşov, 2012
10. A.E.A. Almaini. Electronic Logic Systems, Ed. Prentice Hall, 1994.
11. John F. Wakerly. Circuite Digitale, Editura Teora, Bucuresti, 2002.
12. Rabaey J.M., Chandrakasan A., Nikolic B. Digital Integrated Circuits. A design perspective. Prentice Hall, 2003.
13. Weste, N.H.E., Eshraghian, K. Principles of CMOS VLSI Design. A System perspective. Addison-Wesley Publishing Company, 1993

Electronic material:

15. Hintea, S. Pagina web a disciplinei de Circuite integrate digitale (prezentari curs, lucrari de laborator, probleme propuse, subiecte de examen), http://www.bel.utcluj.ro/ci/rom/cid/index.htm
16. Marcovitz: Introduction to Logic Design, McGraw Hill, New York, 2005
17. Morris Mano, Michael Ciletti: Digital Design, Prentice Hall, SUA, 2007

1. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

2. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired theoretical knowledge and practical skills		- Summative evaluation written exam (theory and problems)		- E, max 10 pts. 80%
Applications		The level of acquired abilities		- Continuous formative evaluation - practical lab test		- L, max. 10 pts. 20%
10.4 Minimum standard of performance						
$L \geq 5$ and $E \geq 4$ and $0,2L+0,8E \geq 4.5$						

Date of filling in	Course responsible	Teachers in charge of applications
1.10.2018	Assoc. Prof Mihaela Cîrlugea, Ph.D	Assoc. Prof Mihaela Cîrlugea, Ph.D