SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Electronics, Telecommunications and information Technology
1.3 Department	Bases of Electronics
1.4 Field of Study	Electronic Engineering, Telecommunications and Information Technologies
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	Theoretical area Methodologic area Analysis area						
2.3 Course responsible/lecturer	Assoc. Prof Mihaela CIRLUGEA, Ph.D., Mihaela.Cirlugea@bel.utcluj.ro						
2.4 Teachers in charge of applications	Assoc. Prof Mihaela CIRLUGEA, Ph.D., Mihaela.Cirlugea@bel.utcluj.ro Assist. Prof. Paul FARAGO, Ph.D., Paul.Farago@bel.utcluj.ro						
2.5 Year of study	II	2.6 Semester	3	2.7 Assessment	E	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	4	Of which: 3.2 course	2	3.3 seminary / laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminary / laboratory	28
Time distribution					hours
Studying the manual, lecture material and notes, references					20
Supplementary study in the library, online and in the field					-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays					16
Tutoring					4
Exams and tests					4
Other activities					-

3.7 Total hours 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	Digital Integrated Circuits
4.2 Competencies	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	C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology C2. Applying the basic methods for the acquisition and processing of signals C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming techniques C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks
Transversal competences	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 digital circuits
7.2 Specific objectives	1. Recognizing and understanding basic concepts specific to fundamental digital electronic circuits. 2. Developing skills and abilities necessary for the use of fundamental digital electronic circuits. 3. Developing skills and abilities for the analysis and (re)design of digital integrated circuits.

8. Contents

8.1 Course	Teaching methods	Observations
1. Introduction to the Binary Logic. Nummeration 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. Synchronous and asynchronous frequency dividers with counters		
13. Latches and serial registers		
14. Sequential Synchronous Automata with Counters and Registers.		

References

1. S Hintea, G Csipkes, D Csipkes, P Farago, M Cirlugea:Digital Integrated Circuits, Casa Cartii de Stiinta, Cluj-Napoca, 2017
2. M. Cîrlugea: DIC Course notes
3. Paul Farago, Botond Kirei, Gabor Csipkes, Sorin Hintea - DESCRIEREA IN VHDL A SISTEMELOR CU CIRCUITE INTEGRATE DIGITALE - Indrumator de Proiectare si Simulare. Editura U.T.PRESS, Cluj-Napoca, 2014
4. S. Hintea, Lelia Feştilă, Mihaela Cîrlugea – Circuite Integrate Digitale.UT Press, 2005
5. Gabor Csipkes, Doris Csipkes, Sorin Hintea, Mihaela Cîrlugea - "Circuite integrate digitale: culegere de probleme", editura UT Press 2011
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. Dan Nicula. Electronica digitala. Carte de invatatura. Editura Universităţii TRANSILVANIA din Braşov, 2012
9. A.E.A. Almaini. Electronic Logic Systems, Ed. Prentice Hall, 1994.
10. John F. Wakerly. Circuite Digitale, Editura Teora, Bucuresti, 2002.
11. Rabaey J.M., Chandrakasan A., Nikolic B. Digital Integrated Circuits. A design perspective. Prentice Hall, 2003.
12. Weste, N.H.E., Eshraghian, K. Principles of CMOS VLSI Design. A System perspective. Addison-Wesley Publishing Company, 1993

Materiale didactice virtuale

13. 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
14. Marcovitz: Introduction to Logic Design, McGraw Hill, New York, 2005
15. Morris Mano, Michael Ciletti: Digital Design, Prentice Hall, SUA, 2007

8.2 Laboratory	Teaching methods	Notes
1. Labour protection. Introduction in VHDL, Vivado medium and the digital development board Basys3	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards,

2. Circuits with logic gates		computers, white/magnetic board
3. Circuits with multiplexers		
4. Flip-flops basics		
5. Applications with flip-flops		
6. Circuits with counters		
7. Circuits with shift registers		
8.3 Seminary		
1. Fundamental logic functions, minimization, logic operations		
2. Analysis and synthesis of circuits containing gates.and elementary logic gates simulation		
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		
References 1. Gabor Csipkes, Doris Csipkes, Sorin Hintea, Mihaela Cîrlugea - "Circuite integrate digitale: culegere de probleme", editura UT Press 2011 2. C. Rus, S.Hintea, Doris Csipkes. Circuite integrate digitale.Structuri interne. Indrumator de laborator. U.T. Press, Cluj-Napoca, 2006		

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

The discipline content and the acquired skills are in agreement with the expectations of the professional 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).

10. Assessment

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	- Summative evaluation written exam (theory and problems)	90%
10.5 Laboratory/Seminary	The level of acquired abilities	- Continuous formative evaluation - practical lab test	10%
10.6 Minimum standard of performance			
Quality level: Minimum knowledge: ✓ *Knowing the basic binary mathematical operations* ✓ *Knowing the basic digital circuit components*			

- ✓ *To understand signal and state diagrams specific to digital components*
- ✓ *To recognize the main digital circuit applications*

Minimum competences:

- ✓ *To be able to solve K-maps*
- ✓ *To be able to implement simple digital circuits in given specifications*
- ✓ *Knowledge of basic procedures for circuit design*

Quantitative level:

- ✓ *Participation to all laboratory classes*
- ✓ *Minimal 5 grade for each, laboratory and exam*

*The final grade is calculated as: 0,9*Exam_grade+0,1*Laboratory_grade*

$L \geq 5$ and $E \geq 5$ and $0,9*E+0,1*L \geq 5$

Data of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
27.09.2021	Course	Assoc. Prof Mihaela CIRLUGEA, Ph.D.	
	Applications	Assoc. Prof Mihaela CIRLUGEA, Ph.D.	
		Assist. Prof. Paul FARAGO, Ph.D.	

Date of approval in the Department of Communications 27.09.2021	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 27.09.2021	Dean Prof. Gabriel OLTEAN, Ph.D.