SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Computer science/ Engineer
1.7 Form of education	Full time
1.8 Subject code	11.

2. Data about the subject

2.1 Subject name	***Digital Systems Design***				
2.2 Course responsible/lecturer	Prof. dr. eng. Creţ Octavian Augustin – Octavian.Cret@cs.utcluj.ro				
2.3 Teachers in charge of seminars/ laboratory/ project	As.Drd.Ing. Diana Irena Pop – Diana.Pop@cs.utcluj.ro				
2.4 Year of study	I	2.5 Semester	2	2.6 Type of assessment (E - exam, C - colloquium, V - verification)	E
2.7 Subject category	*DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară*				DD
	DI – Impusă, DOp – opțională, DFac – facultativă				DI

3. Estimated total time

3.1 Number of hours per week	5	of which:	Course	3	Seminars		Laboratory	2	Project	
3.2 Number of hours per semester	70	of which:	Course	42	Seminars		Laboratory	28	Project	
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										25
(b) Supplementary study in the library, online and in the field										17
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										17
(d) Tutoring										6
(e) Exams and tests										9
(f) Other activities:										0

3.4 Total hours of individual study (suma (3.3(a)…3.3(f)))	80
3.5 Total hours per semester (3.2+3.4)	150
3.6 Number of credit points	6

4. Pre-requisites (where appropriate)

4.1 Curriculum	Logic Design
4.2 Competence	At least one high level programming language (i.e. C or PASCAL)

5. Requirements (where appropriate)

5.1. For the course	A minimum of 75% course attendance rate is mandatory for being admitted to the final exam.
5.2. For the applications	Preliminary preparation of summaries from the indicated bibliography (laboratory textbook)

6. Specific competence

6.1 Professional competences	**C2 –** Designing hardware, software and communication components **C2.1** - Describing the structure and functioning of computational, communication and software components and systems **C2.2 –** Explaining the role, interaction and functioning of hardware, software and communication components **C2.3 –** Building the hardware and software components of some computing

	systems using algorithms, design methods, protocols, languages, data structures, and technologies **C2.4 –** Evaluating the functional and non-functional characteristics of the computing systems using specific metrics **C2.5 –** Implementing hardware, software and communication systems
6.2 Cross competences	N/A

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

7.1 General objective	• The main objective of this discipline is to give to the students the bases of Digital Systems Design, in order to make them able to analyze, design and implement any complex digital system.
7.2 Specific objectives	To reach this goal, students will learn to: • Apply Digital System Design principles and descriptive techniques; • Understand various aspects of Automata Theory with applications in the field of Digital Systems Design; • Describe any digital system in VHDL; • Utilize programmable devices such as FPGAs and PLDs to implement digital systems.

8. Contents

8.1 Lectures	Hours	Teaching methods	Notes
VHDL hardware description language – basic design units, signals	3	Blackboard presentation discussions	
VHDL hardware description language – generics, constants, operators, data types, attributes	3		
VHDL hardware description language – sequential domain	3		
VHDL hardware description language – concurrent domain	3		
Creating testbenches for simulating and testing circuits in VHDL	3		
Automata (Finite State Machines) Theory – classification, definitions, formal models	3		
Microprogramming	3		
Microprogrammed Devices	3		
Designing Synchronous Automata	3		
Analysis and Design (Synthesis) of Asynchronous Automata (I)	3		
Analysis and Design (Synthesis) of Asynchronous Automata (II)	3		
Automata Identification	3		
Lossless Machines	3		
Linear Automata	3		

Bibliography

1. Digital Design Principles and Practices, John F. Wakerly, Prentice-Hall, 2000.
2. Automate programabile, Th. Borangiu, R. Dobrescu, Ed. Academiei, 1986.
3. Advanced Digital Logic Design Using VHDL, State Machines, and Synthesis for FPGA's, Sunggu Lee, Thomson-Engineering; 1 edition (April 25, 2005), ISBN 0534466028.
4. PowerPoint slides for VHDL and Automata Theory lectures + sets of problems for the individual study: http://users.utcluj.ro/~lucia/index.html

8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Introduction to VHDL	2	Practical work on test boards, FPGA boards, specialized software, blackboard presentations, supplemental explanations and discussions	
Basic design units in VHDL	2		
Signals, generics, constants, in VHDL	2		
Operators, data types in VHDL	2		
Attributes in VHDL	2		
Sequential domain. Processes in VHDL	2		
Sequential statements in VHDL	2		
Concurrent domain in VHDL	2		
Concurrent statements in VHDL	2		
Sub-programs in VHDL	2		

Testbenches in VHDL	2		
Standard and predefined packages in VHDL	2		
Mini-projects delivery	2		
Lab test	2		

Bibliography

1. Limbajul VHDL, Îndrumător de laborator, Ediţia a-3-a. O. Creţ, L. Văcariu, Ed. U.T. Press, Cluj-Napoca, 2007.
2. PowerPoint slides for VHDL and Automata Theory lectures + sets of problems for the individual study: http://users.utcluj.ro/~lucia/index.html

Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.

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

• 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 Logic Design (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	Assessment criteria	Assessment methods	Weight in the final grade
Course	Problems solving abilities Presence, (Inter)activity	Written Exam (on MOODLE, TEAMS or ZOOM platform in case of pandemia)	60%
Homeworks	Problems solving abilities	Practical Evaluation (on MOODLE, TEAMS or ZOOM platform in case of pandemia)	20%
Laboratory	Problems solving abilities Presence, (Inter)activity	Practical Evaluation (hands-on) (on MOODLE, TEAMS or ZOOM platform in case of pandemia)	20%
Project			

Minimum standard of performance:
Modeling and solving typical Digital Systems Design problems using the domain-specific formal apparatus.
Grade calculus: 20% lab + 20% miniproject + 60% final exam
Conditions for participating in the final exam: Lab ≥ 5, Project ≥ 5
Conditions for promotion: final exam ≥ 5
For participating in the final written exam minimum of 80% course attendance rate is necessary.

Date of filling in:	**Titulari**	**Titlu Prenume NUME**	**Semnătura**
	Course	Prof. dr. eng. Octavian Cret	
	Applications	As.drd.ing. Diana Pop	

Date of approval in the department	Head of department Prof.dr.ing. Rodica Potolea
Date of approval in the Faculty Council	Dean Prof.dr.ing. Liviu Miclea