

## 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	Applied 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	Applied Electronics / Engineer
1.7 Form of education	Full time
1.8 Subject code	54.20

### 2. Data about the subject

2.1 Subject name	Automate Testing Elements						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assist. Prof. Jano Rajmond, PhD Eng. <a href="mailto:Rajmond.Jano@ael.utcluj.ro">Rajmond.Jano@ael.utcluj.ro</a>						
2.4 Teacher in charge with seminar / laboratory / project	Assist. Prof. Jano Rajmond, PhD Eng. <a href="mailto:Rajmond.Jano@ael.utcluj.ro">Rajmond.Jano@ael.utcluj.ro</a> Eng. Ilies Adelina Ioana, PhD Stud. <a href="mailto:Adelina.Ilies@ael.utcluj.ro">Adelina.Ilies@ael.utcluj.ro</a>						
2.5 Year of study	IV	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DS/DO

### 3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	104	of which: 3.5 course	28	3.6 seminar / laboratory	28
Distribution of time					hours
Manual, lecture material and notes, bibliography					35
Supplementary study in the library, online specialized platforms and in the field					4
Preparation for seminars / laboratories, homework, reports, portfolios and essays					24
Tutoring					3
Exams and tests					3
Other activities: .....					-
3.7 Total hours of individual study	69				
3.8 Total hours per semester	125				
3.9 Number of credit points	5				

### 4. Pre-requisites (where appropriate)

4.1 curriculum	Passive Electronics Components and Circuits Integrated Digital Circuits
4.2 competence	To know the methods of analyzing electronic circuits To know the means of simulation and modeling of electronic circuits To evaluate and interpret the data obtained from the simulation of electronic circuits

## 5. Requirements (where appropriate)

5.1. for the course	Amphitheatre, Cluj-Napoca
5.2. for the seminars / laboratories / projects	Laboratory, Cluj-Napoca

## 6. Specific competences

Professional competences	<p>C3. Application of the basic knowledge, concepts and methods regarding the architecture of computing systems, microprocessors, microcontrollers, programming languages and techniques</p> <ul style="list-style-type: none"> <li>• C3.4 Development of programs for a general and / or specific programming language, starting from the specification of the requirements and until the execution, debugging and interpretation of the results in correlation with the processor used</li> <li>• C3.5 Projects involving hardware (processors) and software (programming) components</li> </ul> <p>C4. To design and use low complexity hardware and software applications, specific to applied electronics</p> <ul style="list-style-type: none"> <li>• C4.1 To define the concepts, principles and methods used in the fields of computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures</li> <li>• C4.2 Explanation and interpretation of the specific requirements of the hardware and software structures in the fields: computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures</li> <li>• C4.3 Identification and optimization of hardware and software solutions of problems related to: industrial electronics, medical electronics, automotive electronics, automation, robotics, production of consumer goods</li> </ul> <p>C6. To solve technological problems, specific to applied electronics</p> <ul style="list-style-type: none"> <li>• C6.1 Defining the principles and methods underlying the manufacture, adjustment, testing and troubleshooting of the appliances and equipment in the fields of applied electronics</li> <li>• C6.2 Explanation and interpretation of the production processes and maintenance activities of electronic equipment, identifying test points and electrical measurements to be measured</li> </ul>
Cross competences	<p>CT1. Methodical analysis of problems encountered in the activity, identifying the elements for which there are established solutions, thus ensuring the fulfillment of professional tasks</p>

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

7.1 General objective	Development of skills in the field of simulation and modeling and especially of electronic circuit testing
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7.2 Specific objectives	<ol style="list-style-type: none"> <li>1. Assimilation of theoretical knowledge regarding the simulation of electronic circuits</li> <li>2. Obtaining the skills for using the electronic simulation programs</li> </ol>
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## 8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Introductory course	Presentation. Discussions	Projector
2. Manifestation of defects in logical systems		
3. Generation of deterministic test vectors (ATGs) for combinational circuits		
4. Generation of deterministic test vectors (ATGs) for sequential circuits		
5. Methods for generating random tests (RTG)		
6. Pseudo-random sequence generators		
7. Data compression methods and techniques		
8. Design principles for testability		
9. Structured design for testability		
10. Test Standard 1149.1		
11. Test Standard 1149.4		
12. Other standards used in testing		
13. Indirect testing methods - IDDQ testing		
14. Indirect testing methods - thermal testing		
<b>Bibliography</b> <ol style="list-style-type: none"> <li>1. Pitică Dan - Elemente de testare pentru sisteme electronice, Editura Albastră, 2001</li> <li>2. Abramovici M., Breuere M., Friedman A. – Digital Systems Testing and Testable Design, Computer Science Press, 1998</li> <li>3. Rajmond Jano, Gabriel Chindris – Hardware and Software Testing Principles: Hands-on Training Guide, Mediamira, 2016, ISBN 978-973-713-345-8</li> </ol>		
<b>Virtual materials</b> <ol style="list-style-type: none"> <li>1. Rajmond JANO, Elemente de testare automata, PowerPoint presentations: <a href="http://www.ael.utcluj.ro/beta/?page_id=569&amp;lang=ro">http://www.ael.utcluj.ro/beta/?page_id=569&amp;lang=ro</a></li> </ol>		
8.2 Seminar / laboratory / project	Teaching methods	Notes
1. Parametric defects and short circuit defects in logical structures	Presentation. Discussions	Computer, Microsoft Office 365 Suite, Microsoft Windows 10, Visual Studio Code, browser
2. Erroneous logical impulse type errors		
3. Using SCAN Logs in Testing		
4. Study of the IEEE1149.1 standard		
5. Generation of pseudo-random tests		
6. Signature analyzers		
7. IDDQ testing		
<b>Bibliography</b> <ol style="list-style-type: none"> <li>4. Pitică Dan - Elemente de testare pentru sisteme electronice, Editura Albastră, 2001</li> <li>5. Abramovici M., Breuere M., Friedman A. – Digital Systems Testing and Testable Design, Computer Science Press, 1998</li> <li>6. Rajmond Jano, Gabriel Chindris – Hardware and Software Testing Principles: Hands-on Training Guide, Mediamira, 2016, ISBN 978-973-713-345-8</li> </ol>		

Virtual materials

2. Rajmond JANO, Elemente de testare automata, PowerPoint presentations:
1. [http://www.ael.utcluj.ro/beta/?page\\_id=569&lang=ro](http://www.ael.utcluj.ro/beta/?page_id=569&lang=ro)

### 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 organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of Automated Testing Elements), and the expectations of the national organization for quality assurance (ARACIS).

### 10. Evaluation

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	Written exam	70%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Practical evaluation	30%

#### 10.6 Minimum standard of performance

##### Quality level:

Minimum knowledge:

- ✓ Know how to adopt methods, techniques and test strategies appropriate to the investigated system
- ✓ Know how to generate deterministic and pseudo-random test sequences
- ✓ Know how to apply the principles of design for testability

Minimum competences:

- ✓ To use of signature analyzers
- ✓ To use of logic analyzers
- ✓ To use of the facilities of the test standards

##### Quantitative level:

- ✓ Perform all laboratory work
- ✓ The exam and laboratory marks must be at least 5

Date of filling in:	Responsible	Title Surname NAME	Signature
21.06.2024	Course	Assist. Prof. Jano Rajmond, PhD Eng.	
	Applications	Assist. Prof. Jano Rajmond, PhD Eng.	
		Eng. Ilies Adelina Ioana, PhD Stud.	

Date of approval in the Department of Applied Electronics  
28.06.2024

Head of Department  
Prof. Dorin PETREUS, PhD Eng.

Date of approval in the Council of Faculty of Electronics,  
Telecommunications and Information Technology

Dean  
Prof. Ovidiu Aurel POP, PhD Eng.

11.07.2024