Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Department	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time
1.8 Discipline code	49.00

2. Data about the subject

2.1 Subject name	***Reliability and diagnosis***				
2.2 Course responsible/lecturer	Assoc. prof. dipl. eng. Enyedi Szilárd, PhD - Szilard.Enyedi@aut.utcluj.ro				
2.3 Teachers in charge of applications	Assoc. prof. dipl. eng. Stan Ovidiu, PhD – Ovidiu.Stan@aut.utcluj.ro				
2.4 Year of study	4	2.5 Semester	1	2.6 Assessment *(E/C/V)*	E
2.7 Type of subject	*DF – fundamental, DID – in the field, DS – specialty, DC – complementary*				DS
	DOB – compulsory, DOP – elective, FAC – optional				DOB

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminar	0	Laboratory	2	Project	0
3.2 Number of hours per semester	56	of which:	course	28	Seminar	0	Laboratory	28	Project	0
3.3 Individual study										
(a) Manual, lecture material and notes, bibliography										24
(b) Supplementary study in the library, online and in the field										20
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										20
(d) Tutoring										2
(e) Exams and tests										3
(f) Other activities:										0

3.4 Total hours of individual study (sum of (3.3(a)…3.3(f)))	69
3.5 Total hours per semester (3.2+3.4)	125
3.6 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	Systems theory basics; Knowledge of digital circuits; Notions of programming languages and techniques.
4.2 Competence	Identification of techniques, principles, appropriate methods and applying mathematics, focusing on numerical calculation methods in order to solve common problems in engineering systems.

5. Requirements (where appropriate)

5.1. For the course	Course attendance is compulsory.
5.2. For the applications	Laboratory and project attendance is compulsory; Preliminary reading for laboratories is indicated.

6. Specific competences

6.1 Professional competences	**C4** – Design, implementation, testing, operation and maintenance of systems with generic and dedicated equipment, including computer networks for control engineering and applied informatics. Evaluation through monitoring, diagnosis, analysis of experimental data, in accordance with specific standards of performance of the design, implementation, testing, validation, operation and maintenance of equipment and computer networks activities when used for automatic control and

	informatics applications.
6.2 Cross competences	N/A

7. Course objectives

7.1 General objective	Preparation for the combined use of knowledge about reliability analysis, process diagnosis, generation of test vectors and implementing programs test applications.
7.2 Specific objectives	Development of the capacity for the use of process diagnosis functions, techniques for digital systems testing, the use of specialized testing and evaluating software for operational safety programs.

8. Contents

8.1 Lecture	No.hours	Teaching methods	Notes
Basic reliability notions: indicators, mathematical models.	2	Presentation and reading from course notes and references, questions and answers face-to-face and online, case studies.	
Reliability of elements. Reliability of unrepairable systems.	2		
Reliability of repairable systems (maintainability, availability).	2		
Parametric reliability. Reliability tries.	2		
Quality engineering elements: the use of ISO 9000 and 14000 standards.	2		
Introduction to digital systems testing: fault classification, fault modeling.	2		
Structural testing. Automated test vector generation. Fault simulation.	2		
Design for testability: scan methods, the IEEE 1149.1 standard.	2		
BIST (Built-In Self-test) techniques.	2		
Memory testing. Current (IDDQ) testing.	2		
Fault tolerance notions.	2		
Software reliability notions.	2		
Control systems diagnosis methods. Principal component analysis (PCA).	2		
Diagnosis with extended Kalman filters.	2		
Bibliography 1. Abramovici, M., Breuer, M., Friedman, A., “Digital System Testing and Testable Design”, Computer Science Press, 1994. 2. Kishor S. T., Andrea B., “Reliability and Availability Engineering: Modeling, Analysis, and Applications”, Cambridge University Press, 2017. 3. Israel Korean, C. Mani Krishna, “Fault-tolerant systems”, Elsevier, 2007. 4. Mostafa Abd-El-Barr, “Design and analysis of reliable and fault-tolerant computer systems”, Imperial College Press, 2006.			
8.2 Applications (seminar/laboratory/project)	No.hours	Teaching methods	Notes
Reliability Indicators (I)	2	Documentation reading, presentation and exemplification, individual exercises on paper and on the computer, problem solving within a team.	
Reliability Indicators (II).	2		
Reliability of an electric device	2		
Batch testing. ISO 9000 Standards Family.	2		
Circuit Simulation Package.	2		
Single Stuck Line Faults (SSL), Fault Collapsing.	2		
Minimal Test Set.	2		
The D Algorithm	2		
Fault Simulation	2		
Boolean Difference	2		
Binary Decision Diagrams	2		
Boundary Scan.	2		
Program testing techniques.	2		
Techniques for assessing operational safety.	2		
Bibliography 1. Abramovici, M., Breuer, M., Friedman, A., “Digital System Testing and Testable Design”, Computer Science Press,			

1994.
2. Kishor S. T., Andrea B., “Reliability and Availability Engineering: Modeling, Analysis, and Applications”, Cambridge University Press, 2017.
3. Israel Korean, C. Mani Krishna, “Fault-tolerant systems”, Elsevier, 2007.
4. Mostafa Abd-El-Barr, “Design and analysis of reliable and fault-tolerant computer systems”, Imperial College Press, 2006.

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

Continual adaptation of the material to the requirements of potential employers and to the feedback from hired graduates.

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Questions from the material presented at the course. Minimal mark 50%.	Written exam / online exam using Teams/Moodle	65%
Laboratory	Theoretical and practical questions from the material presented at the applications. Minimal mark 50%.	Written/online laboratory project / colloquium using Teams	25%
Minimum standard of performance: Mark M>=5, M=0,65*E+0,25*C+ 0,1*p, where E= exam, C=colloquium/project, p=course attendance.			

Date of filling in:		**Title Firstname NAME**	**Signature**
01.07.2022	Course	Assoc. prof. dipl. eng. Szilárd ENYEDI, PhD	
	Applications	Assoc. prof. dipl. eng. Ovidiu STAN, PhD	

Date of approval by the Department Board	Head of Department Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council	Dean Prof.dr.ing. Liviu Cristian MICLEA