SYLLABUS

1. Data about the study programme

1.1 Higher education 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
1.6 Study programme / Qualification	Automation and Applied Informatics (in English language)
1.7 Form of education	Full-time education

2. Data about the subject

2.1 Subject name	**Reliability and Diagnosis**			Discipline code		**49.00**
2.2 Course lecturer	Assoc. Prof. Dr. Eng. Szilárd ENYEDI – Szilard.Enyedi@aut.utcluj.ro					
2.3 Teachers in charge of applications	Prof. Dr. Eng. Ovidiu STAN – Ovidiu.Stan@aut.utcluj.ro					
2.4 Year of study	4	2.5 Semester	1	2.6 Assessment type		E
2.7 Type of subject	*DF – fundamental, DS – specialty, DC – complementary*					DS
	DOB – compulsory, DOP – elective, DFA – optional					DOB

3. Estimated total time

3.1 Number of hours per week	4	of which:	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	0	3.3 Practice	0
3.4 Number of hours per semester	56	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	0	3.6 Practice	0

3.7 Distribution of time (hours per semester) for individual study and assessment:	
(a) Assessment	3
(b) Study using textbooks, lecture materials, bibliography and notes	24
(c) Additional study in the library, on specialized electronic platforms and in the field	20
(d) Preparation for seminars / laboratories, homework, reports, portfolios and essays	20
(e) Tutoring	2
(f) Other activities	0
3.8 Total hours of individual study and assessment (sum of 3.7(a). 3.7(f))	69
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credits	5

4. Prerequisites (where applicable)

4.1 Curriculum	Notions of systems theory, digital electronics, microprocessor-based systems, programming and numerical methods.
4.2 Competence	Ability to identify suitable techniques, principles and methods for solving common problems in systems engineering; ability to apply mathematical methods, with emphasis on numerical calculation methods; basic skills in using simulation, testing and technical-documentation tools.

5. Requirements (where applicable)

5.1. For the course	Course attendance is compulsory. Lecture notes, an electronic communication platform and the recommended bibliography are used.
5.2. For seminar / laboratory / project activities	Laboratory and project attendance is compulsory. Preliminary reading for laboratory activities is indicated.

6. Specific competences acquired

Professional competences	C3. Use of the fundamentals of automation, process modelling, simulation, identification and analysis methods, and computer-aided design techniques. C4. Design, implementation, testing, operation and maintenance of systems with generic and dedicated equipment, including computer networks, for automation and applied-informatics applications. C6. Application of knowledge of legislation, economics, marketing, business and quality assurance in economic and managerial contexts.
Transversal competences	CT1. Application, in compliance with legislation and intellectual-property rights, including technology transfer, product-certification methodology, principles, norms and values of the professional code of ethics, within one's own strategy of rigorous, efficient and responsible work. CT3. Identification of continuing-education opportunities and efficient use of learning resources and techniques for personal development.

7. Expected learning outcomes

Knowledge	The student identifies and describes concepts, indicators and mathematical models for reliability, maintainability, availability, operational safety and risk. The student explains testing, diagnosis, maintenance, design-for-testability, redundancy and fault-analysis methods for digital systems, automatic systems and software applications. The student describes quality standards and performance requirements used in testing, validation, operation and maintenance of equipment and systems for automation and applied informatics, including classical and intelligent automatic systems.
Skills	The student calculates and interprets reliability indicators and statistical operating data using suitable mathematical methods and computing tools. The student applies methods for process and electrical/electronic system diagnosis, test-vector generation, test-set minimization and fault simulation. The student designs, simulates, implements and verifies digital circuits or software testing applications, selecting appropriate methods and tools for the analyzed problem. The student critically analyses experimental results and documents clearly the solutions, assumptions, limitations and conclusions of laboratory work. The student evaluates reliability, testing and diagnosis issues for systems that include embedded, networked or intelligent components.
Responsibility and autonomy	The student works responsibly and autonomously in testing, diagnosis and reliability-analysis activities, complying with safety, quality and professional-integrity requirements. The student assumes responsibility for the correctness of calculations, simulations, tests and technical interpretations presented in laboratory work. The student uses current bibliographic resources, technical documentation and standards for continuous development of competences in reliability, diagnosis, testing and emerging technologies.

8. Subject objectives (based on the grid of acquired specific competences)

8.1 General objective of the subject	To prepare students for the combined use of knowledge about reli-ability analysis, process diagnosis, test-vector generation and implementation of software-testing applications.
8.2 Specific objectives	To develop the ability to use process-diagnosis functions and techniques for digital-system testing. To develop skills in calculating and interpreting reliability, maintainability, availability and safety indicators. To develop the ability to generate, minimize, simulate and interpret test sets for digital circuits and software-testing applications. To develop the ability to evaluate experimental results and prepare rigorous technical documentation for testing, diagnosis and maintenance solutions. To develop the ability to analyses reliability and diagnosis issues in systems that include emerging, embedded, networked or intelligent technologies.

9. Contents

9.1 Course	No. hours	Teaching methods	Notes
Introduction to reliability and diagnosis.	2	Presentation and Studying based on course notes and bibliography, questions and answers face-to-face and online, case studies.	
Basic reliability notions: indicators, mathematical models.	2		
Quality engineering elements: the use of ISO 9000 and 14000 standards.	2		
Introduction to testing; testing techniques; fault classification.	2		
Test-vector generation; test-set minimization.	2		
Design for testability; scan methods; the IEEE 1149.1 standard.	2		
Built-In Self-Test; BIST techniques.	2		
Memory testing; memory categories; testing techniques.	2		
Testing methods: in-circuit, functional, current-based, memories, microprocessors.	2		
Fault-tolerant systems; indicators; redundancy.	2		
Software testing techniques: runtime environment modelling, test-scenario selection, test execution and result evaluation.	2		
Safety notions; reliability versus safety; risk analysis; integrity levels; safe architectures.	2		
Control-system diagnosis basics: methods, electrical and electronic system diagnosis.	2		
Reliability and diagnosis of emerging technologies.	2		

Bibliography

1. Abramovici, M., Breuer, M., Friedman, A., *Digital System Testing and Testable Design*, Computer Science Press, 1990.
2. Gulati, Ramesh, *Maintenance and Reliability Best Practices*, Industrial Press, 2020.
Kishor S. T., Andrea B., *Reliability and Availability Engineering: Modeling, Analysis, and Applications*, Cambridge University Press, 2017.
4. Israel Koren, C. Mani Krishna, *Fault-Tolerant Systems*, Elsevier, 2007.
Mostafa Abd-El-Barr, *Design and Analysis of Reliable and Fault-Tolerant Computer Systems*, Imperial College Press, 2006.

9.2 Seminar / laboratory / project / practical work	No. hours	Teaching methods	Notes
Reliability indicators (I).	2		
Reliability indicators (II).	2		
Reliability of an electrical device.	2		
Batch testing. ISO 9000 standards family.	2		
Circuit simulation.	2		
Single stuck-line faults.	2	Documentation reading, pre-sensation and exemplification, individual paper-based and computer-based exercises, problem solving within a team.	
Fault collapsing. Minimal test set.	2		
Minimal test set for a circuit with logic gates.	2		
Fault simulation.	2		
Design of a logic circuit using integrated circuits with simple gates and a microcontroller.	2		
Development and implementation of an algorithm for verifying the previously designed logic circuit.	2		
Fault simulation of the circuits made in the previous laboratory activity.	2		
The D algorithm. Boolean difference.	2		
Emerging technologies.	2		

Bibliography

1. Abramovici, M., Breuer, M., Friedman, A., *Digital System Testing and Testable Design*, Computer Science Press, 1990.

2. Gulati, Ramesh, *Maintenance and Reliability Best Practices*, Industrial Press, 2020.

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Mostafa Abd-El-Barr, *Design and Analysis of Reliable and Fault-Tolerant Computer Systems*, Imperial College Press, 2006.

10. Correlation of subject contents with the expectations of the epistemic community, professional associ-ations and representative employers in the field of the programme

The subject contents are continuously adapted to the requirements of potential employers and to feedback from graduates already employed in the field. The subject supports professional activities related to testing, validation, operation, maintenance, reliability analysis and diagnosis of equipment, digital systems, software applications, computer networks and automation systems. The contents are correlated with pro-gramme competences concerning modelling, simulation, testing, operation and maintenance of systems, as well as with current industrial requirements for quality, safety, fault tolerance and reliability assessment in classical, embedded, networked and intelligent systems.

11. Assessment

Activity type	11.1 Assessment criteria	11.2 Assessment methods (and assessment type: continuous/summative)	11.3 Weight in the final grade
11.4 Course	Mastery of concepts, indicators and methods related to reliability, diagnosis and testing; ability to analyses, calculate and interpret technical results.	Written examination or online as-assessments on an institutional platform – summative assessment.	90%
11.5 Seminar/ laboratory/ project/ practical work	Correct completion of laboratory work and practical problems; quality of calculations, simulations and interpretations; ability to apply testing and diagnosis methods in practice; compliance with deadlines.	Practical examination, theoretical and practical questions, laboratory work or online assessment on an institutional platform – continuous assessment.	10%
11.6 Minimum performance standard: grade $G \geq 5$, $G = 0.9 \times E + 0.1 \times C$, where E = exam and C = colloquium/project. Passing requirements: $E \geq 5$ and $C \geq 5$.			

Date of completion:	Teaching staff	Academic rank, title, First name LAST NAME	Signature
29.06.2026	Course	Assoc. Prof. Dr. Eng. Szilárd ENYEDI	
	Applications	Prof. Dr. Eng. Ovidiu STAN	

Date of approval by the Automation Department Board _____	Head of the Automation Department Prof. Dr. ing. Honoriu VĂLEAN
Date of approval by the Faculty Council of Automation and Computer Science _____	Dean Prof. Dr. ing. Vlad MUREȘAN