

SYLLABUS

1. Information about the program

1.1 Higher education institution	Universitatea Politehnică Timișoara
1.2 Faculty ¹ / Department ²	OF ELECTRONICS, TELECOMMUNICATIONS AND INFORMATION TECHNOLOGIES / Applied Electronics Department
1.3 Field of study (name/code ³)	Electronics, Telecommunications and Information Technologies Engineering / 20/20/10
1.4 Study cycle	Master
1.5 Study program (name/code/qualification)	AUTOMOTIVE ELECTRONIC SYSTEMS/ 20/20/10 / 2152

2. Information about discipline

2.1a Name of discipline/The educational classe ⁴	Reliability and Functional Safety Elements of Automotive Electronic Systems / DS / Fiabilitate și siguranță în funcționare în industria automotive						
2.1b Name of discipline in Romanian							
2.2 Coordinator (holder) of course activities	Lect. Eng. Septimiu Lica, B.Sc. (Phys.) Ph.D. (Eng.)						
2.3 Coordinator (holder) of applied activities ⁵	Lect. Eng. Septimiu Lica, B.Sc. (Phys.) Ph.D. (Eng.)						
2.4 Year of study ⁶	1	2.5 Semester	1	2.6 Type of evaluation	E	2.7 Regime of discipline ⁷	DOB

3. Total estimated time (direct activities (fully assisted), partially assisted activities and unassisted activities⁸)

3.1 Number of hours fully assisted/week	4 ,of which:	course	2	seminar/laboratory/project	2		
3.1* Total number of hours fully assisted/sem.	56 ,of which:	course	28	seminar/laboratory/project	28		
3.2 Number of on-line hours fully assisted/sem	26 ,of which:	course	16	seminar/laboratory/project	10		
3.3 Number of hours partially assisted/week	- ,of which:	project, research	-	training	-	hours designing M.A. dissertation	-
3.3* Number of hours partially assisted/ semester	- ,of which:	project of research	-	training	-	hours designing M.A. dissertation	-
3.4 Number of hours of unassisted activities/ week	4,93 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field				1,9	
		Study using a manual, course materials, bibliography and lecture notes				3	
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays				1	
3.4* Total number of hours of unassisted activities/ semester	69 ,of which:	Additional documentation in the library, on specialized electronic platforms, and on the field				2	
		Study using a manual, course materials, bibliography and lecture notes				14	
		Preparation of seminars/ laboratories, homework, assignments, portfolios, and essays				28	
3.5 Total hrs./week ⁹	8,93						
3.5* Total hrs./semester	125						
3.6 No. of credits	5						

4. Prerequisites (where applicable)

4.1 Curriculum	<ul style="list-style-type: none"> Fundamental Electronic Circuits Digital Integrated Circuits Analogue Integrated Circuits Microcontrollers
4.2 Learning outcomes	<ul style="list-style-type: none"> Ability to use a personal computer (PC) Ability to work with abstract mathematical concepts, including statistics

5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> • A room with a minimum of 30 seats, equipped with a video projector. • Students must attend lectures and seminars with their mobile phones set to silent mode. Phone conversations during class will not be tolerated, nor will students be allowed to leave the classroom to take personal calls. • Late arrivals to lectures and seminars will not be tolerated, as they are disruptive to the educational process.
5.2 to conduct practical activities	<ul style="list-style-type: none"> • A room with at least 30 seats, equipped with a video projector and a whiteboard.

6. Learning outcomes acquired through this discipline

Knowledge	<ul style="list-style-type: none"> • C1. The student/graduate demonstrates advanced knowledge of the categories of electronics, the principles of electricity and engineering, and the physics and mathematics required for the design and analysis of complex electronic systems. • C12. The student/graduate identifies regulations, standards, and risks associated with microsystems research and production, including aspects of environmental protection. • C14. The student/graduate explains methods and techniques for modelling power electronic systems, including the analysis of components and their interactions. • C17. The student/graduate explains methods and techniques for designing sensors and integrated sensor systems within complex products.
Skills	<ul style="list-style-type: none"> • A2. The student/graduate conducts scientific research in electronics, developing innovative methods and solutions for circuits, semiconductors, and advanced technological applications. • A3. The student/graduate designs electronic systems, including circuits, equipment, and applications in fields such as automotive and instrumentation. • A20. The student/graduate designs within the field of power electronics, developing circuits and constructive solutions that meet functional and safety requirements.
Responsibility and autonomy	<ul style="list-style-type: none"> • RA2. The student/graduate demonstrates autonomy in leading scientific research and making complex engineering decisions, coordinating multidisciplinary technical teams. • RA3. The student/graduate ensures quality and professional ethics in the design and testing of electronic systems, in compliance with international and national regulations. • RA5. The student/graduate assumes responsibility for preparing and communicating technical reports to stakeholders. • RA15. The student/graduate demonstrates autonomy in modelling and implementing innovative solutions for power circuits.

7. Objectives of the discipline (based on the grid of learning outcomes acquired)

<ul style="list-style-type: none"> • To become familiar with the development principles of systems with a high level of functional safety • To become familiar with elements of reliability theory, hardware and software principles of the systems with a high level of functional safety
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8. Content

8.1 Course	Number of hours	Of which online	Teaching methods
Introduction to reliability theory. Structure functions (types of structures, paths and minimum cuts)	2	2	Lecture supported by slides, explanation, conversation, exercise solving, case study, problematization, comparative analysis, cognitive
The reliability of the systems with independent components. Limits of the reliability function	2	0	
The system life time as a function of the components life time. The estimation of the lifetime using the reliability function	2	0	
The calculation of the failure rates of the electronic components	2	0	

The risk and hazard analysis of the systems. Establishing the required level of functional safety of the automotive systems (HARA)	2	0	conflict induction, Phillips 6-6, debates, Jigsaw method, Venn-Euler diagram, Virtual Campus, email, and various electronic materials.
Principles and examples of hardware architectures of systems with high functional safety	2	0	
Principles and examples of software architectures of the systems with high functional safety	2	2	
Methods of analysis of the systems with required functional safety (FMEA, FTA)	2	0	
The analysis of the failure modes and effects of the diagnoses (FMEDA). The metrics used in the analysis of functional safety.	2	2	
The presentation of the development of a project with a high functional safety system – part I – setting of functional safety requirements (HARA)	2	2	
The presentation of the development of a system project with high functional safety – part II – establishment of the system architecture	2	2	
System analysis: FMEA, FTA. The analysis of the common causes and cascade failures	2	2	
Failure modes and diagnostic effects analysis (FMEDA) – Part I – Fault classification	2	2	
Failure modes and diagnostic effects analysis (FMEDA) – Part II – Evaluation of the functional safety metrics	2	2	
	Bibliography ¹⁰ 1. Siemens Norms SN29500 - Failure rates of components, Expected values 2. IEC TR 62380 – Reliability data handbook – Universal model for reliability prediction of electronics components, PCBs and equipment 3. FIDES guide 2009 Edition A, September 2010 – Reliability Methodology for Electronic Systems 4. IEC 61508 – Functional safety of electrical/electronic/programable electronic safety related systems 5. ISO 26262 Road vehicles – Functional safety 6. Sheldon M. Ross: Introduction to Probability Models – ACADEMIC PRESS, 2007. 7. Alessandro Birolini: Reliability Engineering, Theory and Practice, Seventh Edition – Springer 2014.		
8.2 Applied activities¹¹	Number of hours	Of which online	Teaching methods
Determination of the structure functions	2	2	Comparative Analysis, Problemization, Demonstration, Case Study,
Calculations the reliability of systems with independent components	2	0	
Limits of the reliability functions, systems with non-independent components – common causes	2	0	
Calculations of systems lifetime	2	0	
Calculations of the failure rates of the electronic components. Pasive components	2	2	Exercise Solving on whiteboard,
Active components failure rates	2	0	
Hazard Analysis and Risk Assessment (HARA)	2	2	Debates,
Applied HARA - project	2	0	
Systems with redundant architectures	2	0	Role-Playing,
Examples of redundant architectures - project	2	0	
Failure Modes and Effects Analysis (FMEA)	2	2	Virtual Campus, Email
Fault Tree Analysis (FTA)	2	0	
Failure Modes, Effects and Diagnostic Analysis (FMEDA)	2	2	Electronic Materials
Applied FMEDA - project	2	0	

Bibliography¹²

1. Tomasz Nowakowski, Marek Młyńczak, Anna Jodejko-Pietruczuk, Sylwia Werbińska-Wojciechowska: Safety and Reliability: Methodology and Applications – CRC Press, 2015.
2. Joseph D. Miller: Automotive System Safety: Critical Considerations for Engineering and Effective Management (Quality and Reliability Engineering Series) – Wiley, 2020.
3. Ivo Häring: Technical Safety, Reliability and Resilience - Methods and Processes – Springer, 2021

9. Evaluation

Type of activity	9.1 Evaluation criteria ¹³	9.2 Evaluation methods	9.3 Share of the final grade
9.4 Course	Knowledge of calculating the failure rates of electronic components. Knowledge of calculating the reliability parameters of electronic systems. Understanding how to estimate the level of functional safety required for an electronic system, based on the severity of potential hazards in the event of a failure. Ability to design redundant system architectures that meet a given level of functional safety. Ability to analyse whether a system meets the required functional safety standards. Capability to understand the principles of hardware and software development for systems with a specified level of functional safety.	Exam	60 %
9.5 Applied activities	S:		
	L: Solving applications in accordance with the topics covered in the lectures. Completing assignments.	Active participation and evaluation of submitted assignments	10 %
	P: Apply the concepts in a practical project	Personal project presentation	30 %
	Pr:		
	Tc-R¹⁴:		
9.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified ¹⁵)			
<ul style="list-style-type: none"> Outline knowledge of the calculation of reliability parameters and of the principles for the development of relevant systems in terms of functional safety. 			

Date of completion

24/09/2025

Course coordinator
(signature)

Lect. Septimiu Lica PhD

Coordinator of applied activities
(signature)

Lect. Septimiu Lica PhD

Head of Department
(signature)

Assoc. Prof. Mircea Băbăiță PhD

Date of approval in the Faculty
Council¹⁶

7.10.2025

Dean
(signature)

Prof. Cătălin Căleanu PhD

