Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Electronic Technology and Reliability**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Quality and Safety Engineering in Electronics and Telecommunications

2. Date despre disciplină

2.1 Course name (ro) (en)				Proiect de cercetare-dezvoltare Research and development project			
2.2 Course Lecturer							
2.3 Instructor for practical activities				Prof. dr. ing. Angelica BACIVAROV			
2.4 Year of studies	1	2.5 Semester	II	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	5		2.10 Tipul de notare	Nota

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week	1	Out of which: 3.2 course	0.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	14.00	Out of which: 3.5 course	0	3.6 seminary/laboratory	14
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					34
Tutoring					0
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	36.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Not applicable.
4.2 Results of learning	Not applicable.

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	Not applicable.
5.2 Seminary/ Laboratory/Project	The applications will take place in a room equipped with computers, the necessary software, Internet access.

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

In this research-development project, students will familiarize themselves with the practical implementation of increasing the reliability of a system (mainly by using fault tolerance) and optimizing the reliability / maintainability of a complex system in the presence of various constraints (mainly economic). The discipline will lead to the development of skills to increase / optimize the reliability / maintainability of an electronic / telecommunications system taking into account the existence of various constraints.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Demonstrate basic knowledge of electronic systems reliability and maintainability. Correlate reliability and maintainability knowledge. Apply field-specific knowledge in practice. Apply standardized methods and tools to carry out the evaluation and diagnosis process of a situation, depending on the identified/reported problems, and identify solutions. Argue and analyze coherently and correctly the context of application of the basic knowledge of the field, using key concepts of the discipline and the specific methodology.
Transversal (General) Competences	Works in a team and communicates effectively, coordinating efforts with others to solve problem situations of medium complexity. Autonomy and critical thinking: the ability to think in scientific terms, search and analyze data independently, and draw and present conclusions / identify solutions. Ability to analyze and synthesize: presents the acquired knowledge in a synthetic way, as a result of a process of systematic analysis. Respect the principles of academic ethics: correctly cite the bibliographic sources used in the documentation activity. Puts elements of emotional intelligence into practice in the appropriate social-emotional management of real-life/academic/professional situations, demonstrating self-control and objectivity in decision-making or stressful situations. Assume roles / functions of managing the activity of groups, teams or projects.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* • Listing the most important elements and concepts related to the reliability and maintainability of electronic systems and fault tolerance. • Defining notions specific to the field of reliability and maintainability of electronic systems. • Defining notions specific to the domain of fault-tolerant architectures. • Describing/classifying notions/processes/phenomena/structures. • Highlighting consequences and relationships.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* • Selecting and grouping relevant information in a given context. • Reasonably using specific principles in order to improve the dependability of the systems. • Working productively in a team. • Elaborating a scientific text. • Experimentally verifying identified solutions. • Solving practical applications. • Adequately interpreting causal relationships. • Analyzing and comparing performance, identifying strengths/weaknesses. • Identifying solutions and developing solution/project plans. • Formulating conclusions to the experiments carried out. • Arguing the identified solutions/solutions.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selecting appropriate bibliographic sources and analyzing them. • Respecting the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrating responsiveness to new learning contexts. • Demonstrating collaboration with other colleagues and teaching staff in carrying out teaching activities • Demonstrating autonomy in organizing the learning situation/context or the problem situation to be solved • Demonstrating social responsibility through active involvement in student social life/involvement in academic community events • Promoting/contributing through new solutions related to the specialized field to improve the quality of social life. • Realizing the value of his contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility). • Applying principles of professional ethics/deontology in the analysis of the technological impact of the proposed solutions in the specialized field on the environment. • Analyzing and capitalizing on business/entrepreneurial development opportunities in the specialized field. • Demonstrating real-life situation management skills (collaborative vs. conflict time management).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modelling), but also on action-based methods, such as exercise, practical activities and problem solving.

In carrying out the activities, lectures will be used, based on PowerPoint presentations or different videos that will be made available to the students. Each session will begin with a recap of the chapters already covered, with an emphasis on the concepts covered in the last session.

Presentations use images and diagrams so that the information presented is easy to understand and assimilate.

This discipline covers information and practical activities designed to support students in their learning efforts and the development of optimal collaborative and communicative relationships in a climate conducive to discovery learning.

The practice of active listening and assertive communication skills, as well as feedback construction mechanisms, will be considered as ways of regulating behavior in various situations and adapting the pedagogical approach to the students' learning needs.

The ability to work in a team to solve different learning tasks and research topics will be practiced.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Defining projects and documentation methodology in national / international databases for the chosen topic	2
2	Establishing individual themes and research methodology	2
3	Establishing the approaches and software packages required for computer-aided analysis of the reliability and maintainability of complex systems	2
4	Establishing the project matrix and the monitoring plan	2
5	Project management	2
6	Analysis of risks related to the project	2
7	Presenting the project	2
	Total:	14

Bibliography:

- V. Cătuneanu, Angelica Bacivarov, Structuri electronice de înaltă fiabilitate. Toleranţa la defectări, Ed. Militară, 1989.
- I. Bacivarov, A.Kobi, Quality and Dependability, Mediarex 21, 2006.
- I. Bacivarov, Angelica Bacivarov, A. Mihalache, Fiabilitatea şi mentenabilitatea sistemelor, Electronica 2000, 2005.
- A. Birolini, Design of Reliability, Concurrent Engineering - Wiley, 2010.
- "IEEE Transactions on Reliability" and "Reliability Engineering & System safety" journal collections.
- http://www.euroqual.pub.ro/cursuri/.
- Moodle course support - https://curs.upb.ro

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Not applicable	Not applicable	
11.5 Seminary/laboratory/project	- knowledge of fundamental theoretical notions; - knowledge of how to apply the theory to specific problems	- assessment of the content / drafting of the project	60%
	- attendance, activity	- assessment of the activity during the semester	20%
	- knowing how to use integrated problem development environments - completion of a project with a predefined theme	- project presentation	20%
11.6 Passing conditions			
• Fulfilling the obligations characteristic of the project activity: submitting and presenting the elaborated projects. • Obtaining 50% of the score related to the activity during the semester.			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

• Through the activities carried out, students develop skills to offer solutions to problems and propose ideas to improve the state of the art in the field of reliability and maintainability of electronic systems and fault tolerant architectures

• Knowledge / aspects / phenomena described by specialized literature / own research published / presented in journals and scientific conferences were taken into account in the development of the content of the discipline

• Through the activities of this discipline, the development of the student's skills to manage practical situations that can be faced in real life is considered in order to increase his contribution to the improvement of the socio-economic environment.

Date	Course lecturer	Instructor(s) for practical activities
21.09.2026		Prof. dr. ing. Angelica BACIVAROV

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Date of department approval	Head of department
	Conf. dr. ing. Marian VLĂDESCU
Date of approval in the Faculty Council	Dean
22.09.2026	Prof. Dr. Mihnea Udrea

