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	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Networks and Telecommunications Software

2. Date despre disciplină

2.1 Course name (ro) (en)				Calitate şi fiabilitate Quality and reliability			
2.2 Course Lecturer				Prof. dr. ing. Ioan BACIVAROV			
2.3 Instructor for practical activities				As. drd. ing. Sebastian ARGHIRESCU, Dr. ing. Gabriel PETRICĂ			
2.4 Year of studies	4	2.5 Semester	2	2.6. Evaluation type	V	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	04.S.08.O.003		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	2	Out of which: 3.2 course	1	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	28	Out of which: 3.5 course	14	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.					20
Tutoring					0
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	22.00
3.8 Total hours per semester	50
3.9 Number of ECTS credit points	2

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Attending the following courses: Special mathematics, Chemistry, Physics, Passive and active electronic components, Electronic systems and circuit design, Decision and estimation in information processing
4.2 Results of learning	Fundamental concepts of probability theory and mathematical statistics

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

5.1 Course	Room equipped with a video projector
5.2 Seminary/ Laboratory/Project	Room equipped with computers and specific 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)*

Acquiring the fundamental concepts of quality, reliability and security engineering applicable in electronics / telecommunications. The following are taken into account:
- modeling and analysis of the quality, reliability and security of electronic / telecommunication systems (ETS), considering the stages of design, manufacture and use. An approach based on defects / errors physics and statistical tools is developed to evaluate ETS performances.
- highlighting the basic methods used in reliability laboratories in different companies for the evaluation of specific ETS compliance and reliability indicators.
Applications familiarize students with design elements of quality and reliability control plans for electronic systems. Also, the reliability tests intended to estimate the reliability indicators of the components are designed and the predictive reliability of the electronic circuits is evaluated in the stage of their design.

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	Demonstrates basic/advanced knowledge of electronic / telecommunications systems quality and reliability. Correlate knowledge. Apply knowledge in practice. Apply standardized methods and tools, specific to the field of operational safety, to carry out the evaluation and diagnosis process of a situation, depending on the identified/reported problems, and identifies solutions. Argue and analyze coherently and correctly the context of application of basic knowledge of the field of quality/reliability of complex systems, using key concepts of the discipline and specific methodology.
Transversal (General) Competences	Team work 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.

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.* • Lists the most important stages that marked the development of the quality-reliability-conformity concepts. • The possibility of knowing specific techniques for ensuring and attesting the quality and reliability of products and services, but above all, the ways in which they are made and certified. • Building skills to apply fundamental knowledge of quality and reliability engineering to achieve quality products / processes. • Describes/classifies notions/processes/phenomena/structures specific to deepening basic knowledge in the field of quality and reliability and how to apply them. • Highlights 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).* • Selects and groups relevant information in a given context. • Work productively in a team. • The curriculum of the discipline responds concretely to the current requirements of development and evolution, being connected to the elements of the current technological progress in the field. • Knowledge of management and standardization. • Analyze and compare results. • Identifies solutions and develops plans to solve problems.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities. • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved. • Promotes/contributes new solutions related to the field of expertise to improve existing knowledge. • Realizes the value of his contribution in the field of engineering to the identification of viable/sustainable solutions to solve various problems in the professional activity. • Apply principles of professional ethics/deontology in the analysis of the technological impact of the proposed solutions in the specialized field.

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.)*

The teaching process will explore expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), but also on action-based methods, such as exercise, practical activities and problem solving.
In the teaching activity, lectures will be used, based on Power Point presentations, electronic documentation and multimedia support, materials that will be made available to the students. Each course will start with a recap of the chapters already covered, with an emphasis on the concepts covered in the last course.

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.
Practicing active listening and assertive communication skills, as well as feedback construction mechanisms, will be considered as ways of behavioral regulation in various situations and adapting the pedagogical approach to the students' learning needs. The ability to work in a team will be practiced to solve different learning tasks and some tasks organized by groups of students.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Fundamental concepts in systems quality and reliability engineering	2
2	Electronic / telecommunication systems (ETS) conformity and reliability indices and their estimation 1. Reception and process conformity control 2. Control diagrams 3. Design of reliability tests	3
3	Reliability of electronics and telecommunications systems 1. Failure rate modeling for electronic components 2. Reliability design in design. Methods based on reliability graphs and diagrams	3
4	Quality and reliability of software: 1. Models of process quality 2. Models of services	2
5	ETS maintenance 1. Renewal processes 2. Markovian models of repairable systems	2
6	Security, risk 1. Assurance and validation models 2. Security / safety in IT&C 3. Fault trees and cause consequence diagrams in ETS high functional importance study	2
	Total:	14

Bibliography:
1. Angelica Bacivarov, I.C. Bacivarov, Calitate şi fiabilitate, suport de curs, available on the subject's page from POLITEHNICA e-learning platform - https://curs.upb.ro.
2. Angelica Bacivarov, I.C. Bacivarov, A. Mihalache, Fiabilitatea şi mentenabilitatea sistemelor electronice. Aplicaţii, Ed. Electronica 2000, Bucureşti, 2003.
3. I.C. Bacivarov, Angelica Bacivarov, A. Mihalache, Controlul conformităţii produselor. Aplicaţii, Ed. Electronica 2000, Bucureşti, 2003.
4. I.C. Bacivarov, D. Stoichiţoiu, T. van der Wiele, Progresses in Quality and Dependability, Mediarex, 2009.
5. V. Cătuneanu, Angelica Bacivarov, Structuri electronice de înaltă fiabilitate. Toleranţa la defectări, Editura Militară, Bucureşti, 1999.
6. V. Cătuneanu, I.C. Bacivarov, Fiabilitatea sistemelor de telecomunicaţii, Editura Militară, Bucureşti, 1995.
7. V. Cătuneanu, A. Mihalache, Bazele teoretice ale fiabilităţii, Editura Academiei, Bucureşti, 1983.
8. A. Birolini, Reliability Fundamentals, Springer, 2012.
9. Electronic support on the website https://www.euroqual.pub.ro.

LABORATORY

Crt. no.	Content	No. hours
1	Design of statistical conformity control. Control diagrams. Standard MIL STD105	2
2	Use of STATISTICA software in the study of Gaussian processes	2
3	Statistical data processing from reliability test for reliability indices estimation of ETS	2
4	Extrapolation of reliability data for time intervals different from reliability test intervals	2
5	Provisional reliability analysis of ETS for different working conditions	2
6	Use of Master Design software in performance design of an electronic circuit	2
7	Construction and analysis of fault tree for ETS	2
	Total:	14

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1. Angelica Bacivarov, I.C. Bacivarov, Calitate şi fiabilitate, suport de curs, available on the subject's page from POLITEHNICA e-learning platform - https://curs.upb.ro.
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3. I.C. Bacivarov, Angelica Bacivarov, A. Mihalache, Controlul conformităţii produselor. Aplicaţii, Ed. Electronica 2000, Bucureşti, 2003.
4. I.C. Bacivarov, D. Stoichiţoiu, T. van der Wiele, Progresses in Quality and Dependability, Mediarex, 2004.
5. V. Cătuneanu, Angelica Bacivarov, Structuri electronice de înaltă fiabilitate. Toleranţa la defectări, Editura Militară, Bucureşti, 1999.
6. V. Cătuneanu, I.C. Bacivarov, Fiabilitatea sistemelor de telecomunicaţii, Editura Militară, Bucureşti, 1995.
7. V. Cătuneanu, A. Mihalache, Bazele teoretice ale fiabilităţii, Editura Academiei, Bucureşti, 1983.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Application of theory to specific problems	Homework	20%
	Knowledge of fundamental theoretical notions	Final test (written)	20%
11.5 Seminary/laboratory/project	The correctness of the obtained solutions	Tests during the semester	40%
	Correct use of specific tools	Final laboratory test	20%
11.6 Passing conditions			
• Fulfilling the obligations characteristic of laboratory activity: teaching and supporting laboratory reports. • Obtaining 50% of the score related to the activity during the semester. • To promote the discipline, the student must obtain at least 50% of the total score, in compliance with all the requirements specified in the POLITEHNICA Bucharest / ETTI Regulations.			

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 to propose ideas to improve the existing situation in the field of reliability and quality of complex systems
• 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 practical activities in the "Quality and Reliability" laboratory, the development of the graduate'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
25.09.2025	Prof. dr. ing. Ioan BACIVAROV	As. drd. Sebastian ARGHIRESCU
		Dr. ing. Gabriel PETRICĂ

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Date of department approval	Head of department
26.09.2025	Conf. Dr. Serban Georgica Obreja
Date of approval in the Faculty Council	Dean
26.09.2025	Prof. Dr. Mihnea Udrea