Universitatea Națională de Știință și Tehnologie Politehnica București
Facultatea de Electronică, Telecomunicații și
Tehnologia Informației

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)				Tehnici avansate în siguranţa în funcţionare a sistemelor Advanced techniques in the safe operation of systems			
2.2 Course Lecturer				Dr. ing. Sabina Axinte			
2.3 Instructor for practical activities				Dr. ing. Sabina Axinte			
2.4 Year of studies	2	2.5 Semester	I	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		DA	2.9 Course code	UPB.04.M3.O.14-08		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3	Out of which: 3.2 course	1.00	3.3 seminary/laboratory	2
3.4 Total hours in the curricula	42.00	Out of which: 3.5 course	14	3.6 seminary/laboratory	28
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.					52
Tutoring					0
Examinations					6
Other activities (if any):					0

3.7 Total hours of individual study	58.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Not applicable.

4.2 Results of learning	Acquiring basic knowledge in the areas of: quality / reliability / maintainability, standardization and legislation in quality and operational safety, and Web programming.

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

5.1 Course	The course will be held in a room equipped with a video projector and computer.
5.2 Seminary/ Laboratory/Project	Active participation in both lab courses and project development meetings (in accordance with the regulations of the Master's degree studies in POLITEHNICA Bucharest).

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)*

This course is designed to deepen the knowledge of reliability and dependability acquired by students during the ICSFET Masters course. Accordingly, it reviews a number of advanced methods used in the dependability assessment of complex computer systems. In addition, it expands upon the fundamental concepts required to determine the level of operational safety, to model the safety of information systems within the Software Development Life Cycle (SDLC), and to improve the usability of software applications. The knowledge gained from this course provides a solid foundation of information that is essential for any software reliability analyst.

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 assessing the secure operation of complex computer systems. Applies knowledge of information systems security within the Software Development Life Cycle (SDLC). Applies knowledge to improve the operational security of software applications. Applies standardized, domain-specific methods and tools to carry out the process of assessing and diagnosing a situation based on identified/reported problems, and outlines solutions. Argues and analyses coherently and correctly in the context of the application of basic knowledge of the discipline, using key concepts of the discipline and specific methodology. Uses discipline-specific scientific vocabulary to communicate effectively, both orally and in writing.
Transversal (General) Competences	Works and communicates effectively in a team, coordinating efforts with others to solve problems of medium complexity. Autonomy and critical thinking: ability to think scientifically, to search and analyze data independently, and to draw and present conclusions/identify solutions. Ability to analyze and synthesize: presents acquired knowledge synthetically as a result of a systematic process of analysis. Respects the principles of academic ethics: correctly cites the bibliographical sources used in their documentation. Applies elements of emotional intelligence in the appropriate socio-emotional management of real life/academic/professional situations, demonstrating self-control and objectivity in decision-making or stressful situations.

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.* • Identifies the essential milestones that mark the evolution of software and complex computer systems. • Defines concepts specific to ensuring the reliability and security of information systems. • Describes/classifies concepts/processes/phenomena/structures. • Identifies 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. • Applies specific principles to ensure the reliability and security of software. • Works productively in a team. • Produces a scientific text. • Verifies identified solutions experimentally. • Solves practical applications. • Interprets causal relationships appropriately. • Analyses and compares standards, regulations and documentation relating to the software development lifecycle (SDLC). • Identifies solutions and develops solution/project plans. • Draws conclusions from experimentation. • Argues in favor of identified solutions.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Selects and analyses appropriate bibliographical sources, respecting the principles of academic ethics and correctly citing the sources used. • Demonstrates openness to new learning contexts. • Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities. • Demonstrates autonomy in organizing the learning context or situation to be solved. • Demonstrates social responsibility through active participation in student social life/activities in the academic community. • Promotes/contributes to improving the quality of social life through new solutions related to the field of specialization. • Recognizes the value of their engineering contribution in identifying viable/sustainable solutions to problems in social life (social responsibility). • Applies principles of professional ethics/deontology when analyzing the technological impact of proposed solutions in the field on the environment. • Analyses and exploits opportunities for entrepreneurial development in the field of specialization. • Demonstrates skills in managing real-life situations (time management, collaboration and resolution of hypothetical conflict situations).

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.)*

Based on the analysis of the learning characteristics and the specific needs of the students, the teaching process will explore both expository (lecture, exposition) and conversational-interactive methods, based on discovery learning models, facilitated by direct and indirect exploration of reality (experiment, demonstration, modeling), as well as action-based methods such as exercises, practical activities and problem solving.
Lectures in the form of PowerPoint presentations will be used in the teaching activity. Each course will begin with a review of the chapters already covered, focusing on the concepts covered in the previous course to validate and facilitate learning of the concepts. The presentations use visual aids (pictures, graphs, diagrams, videos) to make the information presented easy to understand and assimilate.
This discipline includes information and practical activities designed to support students in their learning efforts and in developing optimal collaborative and communicative relationships in a climate conducive to discovery learning. It will focus on practicing active listening and assertive communication skills, as well as mechanisms for constructing feedback, as ways to regulate behavior in different situations and to adapt the pedagogical approach to students' learning needs. Students will practice the ability to work in teams on solving different tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Introduction	2
2	Methodologies of software project management. Testing methods and levels.	4
3	Security vulnerabilities and their associated risks. Types of attacks and attackers.	4

4	Modelling product quality in the SDLC. Modelling safety and security, usability, performance and maintainability	4
	Total:	14

Bibliography:

Fenton, N., Bieman, J., "Software Metrics: A Rigorous and Practical Approach" (2014)
Martin, R.C., "Functional Design: Principles, Patterns, and Practices" (2023)
Humble, J., Farley, D., "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" (2010)
Martin, R.C., "Clean Code: A Handbook of Agile Software Craftsmanship" (2008)
Pullum, L., "Software Fault Tolerance Techniques and Implementation" (2001)
Smith, D.J., "Reliability, Maintainability and Risk: Practical Methods for Engineers" (2005)
Shaw, M., Garlan D., "Software Design for Resilient Computer Systems" (2000)
Smith, D.J., Simpson, K.G.L., "Safety Critical Systems Handbook: A Guide to Functional Safety" (2016)
Herrmann, D.S., "Software Safety and Reliability: Techniques, Approaches, and Standards of Key Industrial Sectors" (2000)
Kuzmiakova, A., "Security Designs for the Cloud, IoT, and Social Networking" (2022)
Kofler, M.,Gebeshuber, K., Kloep, P., et al., "Hacking and Security: The Comprehensive Guide to Penetration Testing and Cybersecurity" (2023)
Steirer, T., "Test Automation Fundamentals" (2022)
Yorkston, K., "Performance Testing" (2021)
Newbould, C., "Software Testing Security Tester Guide for ISTQB certification" (2023)
Yorkston, K., "Improving the Test Process: Implementing Improvement and Change" (2013)
Black, R., "Mobile testing" (2018)
ISO/IEC 25000:2014, "Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE)"
ISO/IEC 27001:2022, "Information technology - Security techniques - ISMS"
ISO/IEC 31000:2018, "Risk management"
ISO/IEC 33000:2015, "Systems and software engineering"
Verizon, „Yearly Data Breach Investigations Report"
OWASP, Top 10 (security risks), defining and counteracting them
Course support in Moodle platform - https://curs.upb.ro/2023/course/view.php?id=9654

LABORATORY

Crt. no.	Content	No. hours
1	Security and usability design in the SDLC	4
2	Assessing the usability of a software product	4
3	Establishing the security level of a software system	4
4	Lab quiz	2
	Total:	14

PROJECT

Crt. no.	Content	No. hours
1	Project definition and documentation methodology in national/international databases for the chosen topic.	2
2	Determining individual topics and research methodology	2

3	Establishing approaches and necessary software tools for computer-aided reliability and maintainability analysis of complex systems.	2
4	Defining the project matrix and monitoring plan	2
5	Project management	2
6	Project risk analysis	2
7	Project presentation	2
	Total:	14

Bibliography:

Fenton, N., Bieman, J., "Software Metrics: A Rigorous and Practical Approach" (2014)
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11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Differential analysis of theoretical techniques and methods	- course quiz	10%
	Knowledge of the core theoretical concepts	- final exam (written)	40%
11.5 Seminary/laboratory/project	Appraisal of lab activity	- lab quiz	20%
	Completing a project with a predetermined theme	- project presentation	30%

11.6 Passing conditions
Obtaining a score of more than 50%, attendance at the final evaluation and consistent activity in the laboratories (according to the regulations of the Master's program at POLITEHNICA Bucharest).

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, students develop the ability to provide solutions to specific problems and propose improvement ideas the existing situation in the field of security in the operation of complex information systems, in modeling the security of information systems and improving the usability of software applications.
- When developing the content, knowledge / aspects / phenomena described in the literature / own research published / presented in scientific journals and conferences have been considered.
- Through practical activities in laboratory/project sessions, the aim is to develop the student's ability to manage practical situations that they may face in real life, in order to increase their contribution to the improvement of the socio-economic environment.

Date	Course lecturer	Instructor(s) for practical activities
14.10.2024	Dr. ing. Sabina Axinte	Dr. ing. Sabina Axinte

Date of department approval	Head of department
	Conf. dr. ing. Marian VLĂDESCU

Date of approval in the Faculty Council	Dean
01.11.2024	Prof. Dr. Mihnea Udrea