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	Masters
1.6 Programme of studies	Mobile Communications

2. Date despre disciplină

2.1 Course name (ro) (en)				Simularea sistemelor de comunicaţii			
2.2 Course Lecturer				Conf. Dr. Alexandru Vulpe			
2.3 Instructor for practical activities				Conf. Dr. Alexandru Vulpe			
2.4 Year of studies	1	2.5 Semester	II	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	4		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	1.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	28.00	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.					37
Tutoring					8
Examinations					2
Other activities (if any):					0

3.7 Total hours of individual study	47.00
3.8 Total hours per semester	75
3.9 Number of ECTS credit points	3

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Mobile communication systems
4.2 Results of learning	General knowledge of telecommunication networks and programming

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

5.1 Course	The lecture will be held in a room equipped with a video projector and computer
5.2 Seminary/ Laboratory/Project	Laboratory sessions will take place in a specifically equipped room that must include: computer, mouse, keyboard, specific software

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)*

The discipline presents several software packages for communication systems simulation and focuses on familiarizing students in the laboratory with one of these.
Students will gain the necessary competencies for simulating communication systems (mobile radio channel, MAC level for the most known wireless communication systems: GSM, WiMAX, UMTS, LTE), interfacing with a real test platform, interfacing a simulated network with real equipment, implementing new features using the simulation software.

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 in the field of telecommunications network simulation. • Applies standardized methods and tools specific to simulations for the evaluation and diagnosis of a situation based on identified/reported problems and identifies solutions. • Argues and analyzes coherently and correctly the application context of basic communication system simulation knowledge using key concepts from communication systems and specific methodology.
Transversal (General) Competences	• Works in a team and communicates effectively, coordinating efforts with others to solve moderately complex problem situations. • Autonomy and critical thinking: the ability to think scientifically, to search and analyze data independently, as well as to draw and present conclusions/identify solutions. • Analysis and synthesis capability: presents the knowledge acquired as a result of a systematic analysis process in a synthetic manner. • Respects academic ethics principles: correctly cites the bibliographic sources used in research activities. • Applies elements of emotional intelligence in adequately managing socio-emotional situations from real/academic/professional life, 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.* • Lists the most important stages that have marked the development of network simulation. • Defines specific concepts of network simulation, with an emphasis on mobile communication systems. • Describes/classifies processes in system simulation. • 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).* • Works productively in a team. • Solves practical applications. • Appropriately interprets cause-and-effect relationships. • Analyzes and compares simulation scenarios. • Identifies solutions and develops resolution plans/projects. • Formulates conclusions from the experiments conducted. • Argues the identified solutions/modes of resolution.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Demonstrates receptiveness to new learning contexts. • Exhibits collaboration with other students and teaching staff in the conduct of educational activities. • Shows autonomy in organizing the learning situation/context or the problem situation to be solved. • Displays social responsibility through active involvement in student life/involvement in events within the academic community. • Recognizes the value of their contribution in the field of engineering to identifying viable/sustainable solutions to problems in social and economic life (social responsibility). • Demonstrates real-life situation management skills (time management, collaboration vs. conflict).

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 an analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository (lecturing, presenting) and conversational-interactive methods, based on discovery learning models facilitated by both direct and indirect exploration of reality (experiments, demonstrations, modeling), as well as action-based methods, such as exercises, practical activities, and problem-solving. The presentation of course lessons is combined, relying on the use of a video projector (for communicating theoretical foundations, demonstrations, descriptions of diagrams, etc.), as well as the use of

the blackboard (for exemplifications, justifications, or checks, with direct student participation). The discipline covers information and practical activities aimed at supporting students in their learning efforts and the development of optimal collaboration and communication relationships in a climate conducive to discovery learning. The dialogue with students is open, with questions and answers whenever necessary. Materials used include lecture notes, scientific papers, technical notes, and guides for using network simulators.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	Architecture of a Simulation Application	6
2	Presentation of Simulation Programs	6
3	Example of Modeling a Telecommunications System	2
	Total:	14

Bibliography:
1. Exata User Guide
2. Omnet++ User Guide
3. Note de curs electronice

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Familiarization with a Network Simulator. Running Simple Scenarios	2
2	Simulation of Complex Networks	2
3	Simulation of a GSM Network	2
4	Advanced Wireless Networks	4
5	Modifying the Simulator's Source Code. Implementing Network Functions.	4
	Total:	14

Bibliography:
1. A. Vulpe, Ş. Obreja, O. Fratu, Simularea sistemelor de comunicaţii – îndrumar de laborator, Politehnica Press,2017, ISBN: 978-606-515-779-8

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- Knowledge of the fundamental theoretical concepts of network simulation; - Understanding how various network simulators operate;	Completion of a project involving the analysis and simulation of a communication network in a network simulator, evaluating performance and drawing conclusions.	50%

11.5 Seminary/laboratory/project	- Execution of a simulation scenario with given parameters; - Analysis of simulation results and drawing conclusions	Evaluation of a worksheet with results and answers to various questions, filled out during and submitted at the end of each laboratory session.	50%
11.6 Passing conditions			
• Achieving 50% of the total score. • Achieving 50% of the score related to the activity throughout 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)

The course is designed to meet the communication industry's need for specialists capable of using and developing advanced simulations of communication systems. Students acquire essential competencies for simulating critical aspects of communication systems, highly valued by employers for their role in developing and testing new communication technologies. The course content is continuously updated, reflecting the latest advances in simulation technology and developments in the communications field, ensuring that students are exposed to the most recent tools and methodologies. Special emphasis is placed on using simulation software as a means of exploring new theories and concepts in communications, thus encouraging innovation and research. Adopting a practical and interactive approach in the laboratories allows students to directly experiment with simulation software, thereby solidifying their knowledge through active learning. Participation in international research projects and exchange programs is encouraged, offering students the opportunity to gain global perspectives and collaborate with colleagues and professors from other countries.

Date	Course lecturer	Instructor(s) for practical activities
29.09.2025	Conf. Dr. Alexandru Vulpe	Conf. Dr. Alexandru Vulpe

Date of department approval	Head of department
	Conf. dr. ing. Şerban-Georgică Obreja

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Date of approval in the Faculty Council Dean

Prof. dr. ing. Mihnea Udrea