



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	Services and Network Management

2. Date despre disciplină

2.1 Course name (ro)		Planificarea serviciilor și rețelelor					
(en)		Services and Network Planning					
2.2 Course Lecturer		Prof. Dr. Graziela Sevastita Niculescu					
2.3 Instructor for practical activities		Prof. Dr. Graziela Sevastita Niculescu					
2.4 Year of studies	1	2.5 Semester	II	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type	DS	2.9 Course code	UPB.04.M1.O.11-03	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	2.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	42.00	Out of which: 3.5 course	28	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.					30
Tutoring					14
Examinations					10
Other activities (if any):					4
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	Networks and Services Communication networks
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4.2 Results of learning	General notions about the components of the telecommunications network, traffic generation and quality indicators of its processing General knowledge of probability theory
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5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	The course will take place in a room equipped with a video projector and computers.
5.2 Seminary/ Laboratory/Project	The course will take place in a room equipped with a video projector and computers.

6. General objective (*Referring 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 curricula of the study programme, etc. will be described in a general manner*)

The discipline "Service and Networks Planning" familiarizes students with the main analytical tools for analyzing and processing telecommunications traffic related to various classes of customers and types of services. It is considered the waiting theory, in terms of forwarding flows through communication nodes and congestion control, and graph theory combined with optimization theory, in terms of network routing.

The aim is to master the main problems related to the mathematical models used in the analysis and estimation of the performance of systems and networks that provide traffic service through a brief presentation of the main notions related to random variables and processes, with special reference to the birth and death processes.

In this context, the telecommunications traffic provided by the types of sources existing in today's networks is defined. Depending on the nature of the arrival and customer service processes, the discipline of the queues and the category of resources, the way of evaluating the performance indicators in traffic processing, used in network planning, is specified

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

Specific Competences	<p>Demonstrates basic knowledge of networks and telecommunications traffic</p> <p>Correlates theoretical and practical knowledge</p> <p>Apply knowledge in practice</p> <p>Apply methods and tools specific to the field, to carry out the evaluation and diagnosis process of a situation, depending on the identified problems and identify solutions to solve them.</p> <p>It argues and analyzes coherently and correctly the context of application of the basic knowledge of the field, using key concepts of traffic engineering and the specific methodology.</p> <p>Oral and written communication in Romanian and English: uses the scientific vocabulary specific to the field, in order to communicate effectively, in writing and orally, and demonstrates understanding of the vocabulary related to the field</p>
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<p>Transversal (General) Competences</p>	<p>Works in a team and communicates effectively, coordinating efforts with others to solve problem situations of medium complexity.</p> <p>Autonomy and critical thinking – the ability to think in scientific terms, search and analyze data independently, and draw and present conclusions and identify solutions.</p> <p>Ability to analyze and synthesize - presents the acquired knowledge in a synthetic way, because of a process of systematic analysis.</p> <p>Respect the principles of academic ethics: correctly cite the bibliographic sources used in the documentation activity.</p> <p>Puts elements of emotional intelligence into practice in the appropriate social-emotional management of professional situations, demonstrating self-control and objectivity in decision-making or stressful situations.</p>
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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 accomplishments 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.*)

<p>Knowledge</p>	<p><i>The result of knowledge acquisition through learning. The knowledge represents the totality of facts, principles, theories and practices for a given work or study field. They can be theoretical and/or factual.</i></p> <p>Know the most important stages that marked the development of the field.</p> <p>Correctly defines domain-specific notions.</p> <p>Describes and classifies domain-specific processes and structures</p> <p>Highlights interaction relationships of the components and consequences of some malfunctions</p>
<p>Skills</p>	<p><i>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 instrumentation).</i></p> <p>Select appropriate bibliographic sources and analyze them.</p> <p>Respect the principles of academic ethics, correctly citing the bibliographic sources used.</p> <p>Demonstrates responsiveness to new learning contexts.</p> <p>Demonstrates collaboration with other colleagues and teaching staff in conducting teaching activities</p> <p>Demonstrates social responsibility through active involvement in student social life/involvement in academic community events</p> <p>Realizes the value of its contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility).</p>
<p>Responsibility and autonomy</p>	<p><i>The student's capacity to autonomously and responsibly apply their knowledge and skills.</i></p> <p>Select appropriate bibliographic sources and analyze them.</p> <p>Respect the principles of academic ethics, correctly citing the bibliographic sources used.</p> <p>Demonstrates responsiveness to new learning contexts.</p> <p>Demonstrates collaboration with other colleagues and teaching staff in conducting teaching activities</p> <p>Demonstrates social responsibility through active involvement in student social life/involvement in academic community events</p> <p>Realizes the value of its contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility).</p>



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 exploration direct and indirect of reality (experiment, demonstration, modeling), but also on action-based methods, such as exercise and problem solving.

In the teaching activity, lectures will be used, based on some Power Point presentations that will be made available to the students. Each course will begin with the recapitulation of the notions presented in the previous lectures and which allow the development of the issues of the current course.

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

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

Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	Content	No. hours
1	Analytical tools for modeling and analysis – specifying randomness in communication networks, defining voice and data traffic, the role of traffic engineering, generalities about variables and random processes, Markov chains and birth and death processes	2
2	Modeling of serving systems – systems with exponential arrivals and servings, with finite and infinite queues served ordered, priority or differentiated	12
3	Open networks with deterministic routing composed of lossy/lossless queuing systems	4
4	Networks with M/M/1 (lossless) systems with probabilistic routing with and without return paths	4
5	Routing optimization in connection-oriented networks – formulation of optimization problems and means of solving them	3
6	Traffic planning in networks - establishing traffic volumes through measurements in existing networks, the traffic distribution matrix between communication nodes, determining new matrices for various network extension situations	3
Total:		28

Bibliography:

Lucian Ioan, Graziela Niculescu – *Calitatea serviciilor de telecomunicații*, Ed. MatrixRom, 2013
Alexandru Rusu, Marius Vochin, Lucian Ioan – *Switching systems in telecommunication networks*, Ed. Politehnica 2019

Marius Vochin, Alexandru Rusu, Graziela Niculescu – *Routing in telecommunication networks*, Ed. Politehnica 2019

Lucian Ioan, Marius Vochin, Graziela Niculescu – *Transmission, switching and routing in communication networks*, Ed. Politehnica 201

LABORATORY



Crt. no.	Content	No. hours
1	Lossy systems – assessment of involved traffic volumes, primary overflow and optimal planning of a hierarchical transport network	3
2	M x N connection networks with queues on inputs – evaluation of transit time by modeling for different values of offered traffic	3
3	Queuing traffic processing systems – performance analysis and optimal sizing for various QoS constraints (losses, transit time, queue size)	3
4	Open networks with M/M/1 systems with return routes (Jackson) – evaluation of performance indicators for a topology imposed on variations of ingress traffic and return rates	3
5	Knowledge assessment colloquium	2
	Total:	14

Bibliography:

Lucian Ioan, Graziela Niculescu – *Calitatea serviciilor de telecomunicații*, Ed. MatrixRom, 2013
Alexandru Rusu, Marius Vochin, Lucian Ioan – *Switching systems in telecommunication networks*, Ed. Politehnica 2019
Marius Vochin, Alexandru Rusu, Graziela Niculescu – *Routing in telecommunication networks*, Ed. Politehnica 2019
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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	Knowledge of fundamental theoretical notions and how to apply them to solve specific problems	Final Exam	60 %
11.5 Seminary/laboratory/project	Evaluation of performance indicators for queuing systems and networks	Final colloquium	40 %
11.6 Passing conditions			
<i>The study regulations are applicable in this sense, namely: Obtaining 50% of the total score related to the final verifications</i>			

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 situation in the field of implementation and exploitation of telecommunications systems and networks.

Date

Course lecturer

Instructor(s) for practical activities



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



10.10.2024

Prof. Dr. Graziela Sevastita
Niculescu

Prof. Dr. Graziela Sevastita
Niculescu

Date of department approval

Head of department

27.10.2024

Conf. Dr. Serban Georgica Obreja

Date of approval in the Faculty
Council

Dean

01.11.2024

Prof. Dr. Mihnea Udrea