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	Technologies and Telecommunications Systems

2. Date despre disciplină

2.1 Course name (ro) (en)				Comunicaţii de date - Proiect Data Communications - Project			
2.2 Course Lecturer				S.l./Lect. Dr. Seyed Salar Sefati			
2.3 Instructor for practical activities				S.l./Lect. Dr. Seyed Salar Sefati			
2.4 Year of studies	4	2.5 Semester	1	2.6. Evaluation type	V	2.7 Course regime	Op
2.8 Course type		S	2.9 Course code	04.S.07.A.207		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	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.					20
Tutoring					10
Examinations					6
Other activities (if any):					

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	Basic knowledge of computer programming, data structures and algorithms, object-oriented programming, and basic knowldge network architectures.

4.2 Results of learning	General knowledge of telecommunications systems, algorithms and programming languages.

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

5.1 Course	The course will be held based on computer-aided modern display techniques (video projector or LCD Screen)
5.2 Seminary/ Laboratory/Project	The laboratory is based on a specific infrastructure that includes a PC network and the Linux operating system.

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)*

Students design a simple data communication scenario in which temperature and humidity sensors transmit data to a central server. The data passes through multiple layers — from the physical layer (wireless signals) to the application layer (data displayed on a dashboard). By examining how each layer manages transmission, addressing, and error control, students gain insight into the architecture of data communication and how devices reliably exchange information across a network. The expected outcome is a foundational understanding of core data communication concepts, developed through the use of an advanced simulation system related to data communication.

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	• **Application of fundamental knowledge, concepts, and methods** related to data communication architectures, including layered network models, transmission techniques, addressing, and error control mechanisms. Students design and simulate a simple smart data communication network and analyze how data flows through different communication layers — from the physical layer to the application layer. • **Selection, configuration, and operation of communication components** within simulated environments. The project provides students with the technical and analytical skills needed to identify, understand, and solve issues related to data transmission, addressing, and network performance in modern communication systems.
Transversal (General) Competences	• **Ability to apply theoretical knowledge in practical contexts**, integrating concepts from electronics, computer systems, and communication technologies to analyze and solve real-world networking problems. • **Capacity for analytical thinking and problem-solving**, demonstrated through the design, simulation, and evaluation of data communication systems. • **Effective teamwork and communication skills**, developed through collaborative laboratory work and project-based activities focused on network design and analysis.

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.* Students will understand the structure and operation of data communication systems through the study and simulation of a smart network that connects temperature and humidity sensors to a central server. The course covers the architecture of data communication, including layered models, signal transmission, addressing, and error control. Students will learn how data moves through each layer — from the physical to the application layer — and how reliable communication between devices is achieved. By the end of the course, students will gain practical experience with simulation tools and develop a solid foundation in the principles of data communication.
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).* Main theoretical and practical developments concerning data communication systems and network architectures. Students develop skills in using simulation tools to design, test, and analyze smart data communication networks that integrate sensors and central servers. They will be able to understand, configure, and troubleshoot communication links, analyze data transmission across network layers, and apply protocols and addressing methods as a foundation for more advanced studies and professional applications in data communications.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • • Improve self-learning abilities through independent study and project-based activities. • Enhance the capacity to analyze and select relevant information and technical sources related to data communication. • Develop autonomy in using simulation and analysis tools for network design and evaluation. • Build a foundation for understanding and adapting to new and emerging communication technologies. • Strengthen logical and cognitive abilities applied to problem-solving and system optimization.

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.)*

Oral communication methods and video projector slide-based course support will be used. Course materials include bibliographic books, lecture notes, solved and proposed problem sets, and multimedia presentations. Supplementary learning resources such as online documentation for network simulators and visualization tools are also provided.

Applicative teaching is performed through the simulation of data communication, assisted by multimedia and open-source software tools such as NS-3, Cooja, OMNeT++, Mininet, and Wireshark. Students also can gain hands-on experience with Grafana, and Apache Kafka for data monitoring and visualization.

A major component of the course is the Data Communications Project, where students work in groups of up to three to design, implement, and present a practical data communication system. Each group selects its own topic and demonstrates their solution through a live implementation or simulation demo and a PowerPoint presentation.

10. Contents

PROJECT		
Crt. no.	**Content**	**No. hours**
1	Session 1: Introduction & Course Overview Introduce data communication fundamentals and project expectations. Review available simulation tools (NS-3, Cooja, OMNeT++, Mininet).	2
2	Session 2: Simulation Environments Setup Install and configure NS-3, Cooja, or OMNeT++. Run a basic simulation and submit a short validation report.	2
3	Session 3 (2 hours): Network Design and Topology Modeling Design and implement small IoT or sensor networks. Understand addressing schemes and communication flow.	2
4	Session 4: Data Management and Visualization Understand network performance metrics and QoS. Export simulation data to InfluxDB and build a Grafana dashboard.	2
5	Session 5: Project Development and Troubleshooting Implement the group project scenario end-to-end. Learn debugging and solve the students problems .	2
6	Session 6: Final Presentations and Evaluation Demonstrate final projects and discuss findings. Evaluate communication metrics and teamwork performance. Summary of key learning outcomes and next steps.	2
7	Session 7: Final Presentations and Evaluation Demonstrate final projects and discuss findings. Evaluate communication metrics and teamwork performance. Summary of key learning outcomes and next steps.	2
	Total:	14

Bibliography:

- Forouzan, B. A. (2021). *Data Communications and Networking* (6th Edition). McGraw-Hill Education.
- Kurose, J. F., & Ross, K. W. (2021). *Computer Networking: A Top-Down Approach* (8th Edition). Pearson.
Peterson, L. L., & Davie, B. S. (2022). Computer Networks: A Systems Approach (6th Edition). Morgan Kaufmann.
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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			
11.5 Seminary/laboratory/project	Weekly progress, implementation quality, and individual contribution to the group project.	Continuous assessment based on lab work, simulation results, and weekly progress reports submitted on Moodle.	50%
	Clarity, structure, teamwork, technical accuracy, and quality of the final demonstration and presentation.	Evaluation of final implementation demo and oral presentation with PowerPoint slides.	50%
11.6 Passing conditions			
• Students must obtain a **minimum overall grade of 50%** to successfully pass the course. Participation in laboratory sessions and group project work is mandatory.			

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 aligns with current industry and academic standards in data communications and networking, following EHEA principles.

Date	Course lecturer	Instructor(s) for practical activities
25.09.2025	S.l./Lect. Dr. Seyed Salar Sefati	S.l./Lect. Dr. Seyed Salar Sefati

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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