



COURSE DESCRIPTION

1. Program identification information

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| 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

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|---|--------------------------|-----------------|---------------|----------------------|------|-------------------|----|
| 2.1 Course name (ro) (en) | Semnale și sisteme 1 | | | | | | |
| 2.2 Course Lecturer | Prof. Dr. Simona HALUNGA | | | | | | |
| 2.3 Instructor for practical activities | Prof. Dr. Simona HALUNGA | | | | | | |
| 2.4 Year of studies | 2 | 2.5 Semester | 1 | 2.6. Evaluation type | E | 2.7 Course regime | Ob |
| 2.8 Course type | D | 2.9 Course code | 04.D.03.O.001 | 2.10 Tipul de notare | Nota | | |

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

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|--|-------|--------------------------|----|-------------------------|-------|
| 3.1 Number of hours per week | 5 | Out of which: 3.2 course | 2 | 3.3 seminary/laboratory | 3 |
| 3.4 Total hours in the curricula | 70 | Out of which: 3.5 course | 28 | 3.6 seminary/laboratory | 42 |
| 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. | | | | | 66 |
| Tutoring | | | | | 2 |
| Examinations | | | | | 2 |
| Other activities (if any): | | | | | 0 |
| 3.7 Total hours of individual study | 80.00 | | | | |
| 3.8 Total hours per semester | 150 | | | | |
| 3.9 Number of ECTS credit points | 6 | | | | |

4. Prerequisites (if applicable) (where applicable)

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| 4.1 Curriculum | Completion and/or passing of the following subjects: Mathematical Analysis, Special Mathematics, Fundamentals of Electrical Engineering |
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| 4.2 Results of learning | Acquire the following knowledge: Fourier series for analog and discrete signals Fourier transform for analog and discrete non-periodic signals, Fourier systems analog and discrete systems, general concepts and methods of calculating the response by the integral of convolution integral and Fourier transform |
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5. Necessary conditions for the optimal development of teaching activities (where applicable)

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| 5.1 Course | The course will take place in a room equipped with a projector, computer and blackboard. |
| 5.2 Seminary/ Laboratory/Project | The laboratory will take place in a room with specific equipment, which must include: signal generator, multimeter, oscilloscope, vobulator Compulsory attendance at seminar and laboratory hours (according to the rules internal university rules) |

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 course defines the basic notions and concepts of signal and systems theory. It deals with signals and analogue and discrete systems. The course introduces the basic concepts of signal and system theory. systems and associated general concepts are presented. Continuous-time signals and systems are analysed. and discrete time. The aim is to develop the ability to apply the fundamentals of signal and system concepts and signal processing methods in order to achieve specific functions in electronics.

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.*)



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| <p>Specific Competences</p> | <p>Demonstrates basic knowledge of signal and systems theory analogue and discrete systems. Correlates the knowledge acquired in this course with that acquired in other courses Applies in practice the knowledge acquired in the course. Applies methods and tools specific to the field of signal processing and systems to carry out the evaluation process of a situation encountered in practice and identifies solutions. Argues and analyses coherently and correctly the context of application of knowledge of the field, using key concepts of the discipline and methodology methodology. Oral and written communication in Romanian: uses specific scientific vocabulary field in order to communicate effectively, both orally and in writing. Oral and written communication in a foreign language (English): demonstrates understanding of the vocabulary related to the field in a foreign language</p> |
| <p>Transversal (General) Competences</p> | <p>works as part of a team and communicates effectively, coordinating efforts with others to solve problem situations of medium complexity. Autonomy and critical thinking: ability to think in scientific terms, to search for and analyse data independently and draw and present conclusions / identify solutions. Ability to analyse and synthesise: presents acquired knowledge synthetically, following a systematic process of analysis. Respects the principles of academic ethics: in documentation work, cites correctly cite the bibliographical sources used. Applies elements of emotional intelligence in appropriate social/emotional management of real-life/academic/professional situations, demonstrating self-control and objectivity in decision-making or in stressful situations.</p> |

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.*)

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| <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> Defines and understands domain-specific concepts: spectrum of a signal, transform Fourier transform for continuous signals, discrete-time Fourier transform, properties of systems analogue and discrete systems</p> |
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| Skills | <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>Selects and groups relevant information in a given context. Works in teams. Develops a scientific text in the field of signals. Experimentally verifies identified solutions, solves applications practical applications.</p> |
| Responsibility and autonomy | <p><i>The student's capacity to autonomously and responsibly apply their knowledge and skills.</i></p> <p>Selects suitable literature sources and analyses them. Respects the principles of academic ethics by correctly citing the bibliographical sources used. Demonstrates receptiveness to new learning contexts. Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities. Applies ethical/professional principles in analysing the technological impact of solutions proposed in the specialist field on the environment.</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.*)

Based on the analysis of students' learning characteristics and their specific needs, the process

the teaching process will explore both expository (lecture, exposition) and conversational/interactive teaching methods, based on discovery learning models facilitated by direct and indirect exploration of reality (experiment, demonstration, modelling), but also action-based methods such as exercise, practical activities and problem solving.

Lectures, based on Power Point presentations or different videos that will be made available to students. Each course will begin with a review of the chapters already covered.

with a focus on the concepts covered in the last course. The presentations use pictures 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 efforts to learning and developing optimal collaborative and communicative relationships in a supportive environment learning through discovery.

It will focus on practising active listening and assertive communication skills as well as feedback building mechanisms as ways of regulating behaviour in different situations and adapting the pedagogical approach to students' learning needs.

The ability to work in teams to solve different learning tasks will be practised.

10. Contents

| COURSE | | |
|----------------|---|------------------|
| Chapter | Content | No. hours |
| 1 | Introduction. Class subject. Definitions. Classifications. Elementary signals | 2 |



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|---|--|----|
| 2 | Analog signals. Periodic signals. Fourier series: exponential Fourier series (EFS), Trigonometric Fourier series (SFT), Harmonic Fourier series (SFA) Signal spectrum periodic. Relationships between Fourier series coefficients. Series properties Fourier series. | 5 |
| 3 | Non-periodic analogue signals. Distributions as generalized signals and operations with distributions. Fourier transformation. Spectrum of non-periodic signals. Convolution and correlation analogue signals. | 5 |
| 4 | Systems and general concepts associated with analogue systems. Introduction and classifications. Properties of analogue and discrete-time systems. Definition of function weight for systems analogue systems. Implications of general properties on the weight function. The weight function system function for linear and time invariant analogue systems. Definitions. | 4 |
| 5 | Sampled signals. Sampling theorem. Sampled signal spectrum. Condition Nyquist condition. Sampled signal reconstruction. | 2 |
| 6 | Discrete-time signals. Discrete-time periodic signals. Fourier series and diagrams spectral diagrams. | 4 |
| 7 | Discrete-time non-periodic signals. Fourier transformation of signals in time discrete time. Frequency domain representations. Convolution and correlation of discrete-time signals. | 4 |
| 8 | Systems and general concepts associated with discrete systems. Introduction and classifications. Properties of discrete systems. Weight function, transfer function. Properties discrete systems | 2 |
| | Total: | 28 |

Bibliography:

- 1) I. Constantin, "Semnale și răspunsul circuitelor", București, Editura BREN, 1999
- 2) Ad. Mateescu, N. Dumitriu, L. Stanciu, "Semnale și sisteme. Aplicații în filtrarea semnalelor", Editura Teora, 2001.
- 3) I. Constantin, "Semnale", Tipografia Institutului Politehnic București, 1992
- 4) D. Stanomir, "Semnale și sisteme analogice", Editura Politehnica Press, 2005.
- 5) D. Stanomir, "Semnale și sisteme discrete", Editura Athena, 1997.
- 6) Ad. Mateescu, Al. Șerbănescu, N. Dumitriu, L. Stanciu, "Semnale, circuite și sisteme-probleme", Editura Militară, București, 1998.
- 7) I. Constantin, S. Halunga, I. Marcu, "Semnale și sisteme-probleme", Editura Electronica 2000, București, 2007.
- 8) M. Săvescu, T. Petrescu, S. Ciochină, "Semnale, circuite și sisteme-probleme", Editura Didactică și Pedagogică, București, 1981.
- 9) C. Negrescu, D. Stanomir, Semnale și sisteme-Probleme și soluții, Ed. Politehnica, 2013, București.
- 10) T. Petrescu, "Semnale și sisteme", Ed. POLITEHNICA PRESS, București, 2019.
- 11) M. D. Adams, Signals and Systems, Edition 5.0, Dec. 2022, xlv + 700 pages, ISBN 978-1-990707-00-1 (PDF).
- 12) Mark Wickert, Signals and Systems for dummies, Wiley, 2



| LABORATORY | | |
|-------------------|---|------------------|
| Crt. no. | Content | No. hours |
| 1 | Spectral analysis of analogue periodic signals. | 4 |
| 2 | Introduction to Matlab | 2 |
| 3 | Signal convolution using Matlab | 2 |
| 4 | Fourier transform analysis using Matlab | 4 |
| 5 | Laboratory colloquium | 2 |
| Total: | | 14 |

| SEMINARY | | |
|-----------------|--|------------------|
| Crt. no. | Content | No. hours |
| 1 | Periodic analogue signals. Fourier series | 4 |
| 2 | Fourier analysis of non-periodic signals. Distributions | 4 |
| 3 | General properties of analogue systems in time and frequency. Response methods | 4 |
| 4 | Sampled signals and reconstruction of continuous signals. | 2 |
| 5 | Fourier analysis of discrete periodic signals | 4 |
| 6 | Fourier analysis of non-periodic analog signals | 4 |
| 7 | General properties of discrete time and frequency systems. Response methods | 4 |
| Total: | | 28 |

Bibliography:

- 1) I. Constantin, "Semnale și răspunsul circuitelor", București, Editura BREN, 1999
- 2) Ad. Mateescu, N. Dumitriu, L. Stanciu, "Semnale și sisteme. Aplicații în filtrarea semnalelor", Editura Teora, 2001.
- 3) I. Constantin, "Semnale", Tipografia Institutului Politehnic București, 1992
- 4) D. Stanomir, "Semnale și sisteme analogice", Editura Politehnica Press, 2005.
- 5) D. Stanomir, "Semnale și sisteme discrete", Editura Athena, 1997.
- 6) Ad. Mateescu, Al. Șerbănescu, N. Dumitriu, L. Stanciu, "Semnale, circuite și sisteme-probleme", Editura Militară, București, 1998.
- 7) I. Constantin, S. Halunga, I. Marcu, "Semnale și sisteme-probleme", Editura Electronica 2000, București, 2007.
- 8) M. Săvescu, T. Petrescu, S. Ciochină, "Semnale, circuite și sisteme-probleme", Editura Didactică și Pedagogică, București, 1981.
- 9) C. Negrescu, D. Stanomir, Semnale și sisteme-Probleme și soluții, Ed. Politehnica, 2013, București.
- 10) T. Petrescu, "Semnale și sisteme", Ed. POLITEHNICA PRESS, București, 2019.
- 11) M. D. Adams, Signals and Systems, Edition 5.0, Dec. 2022, xlv + 700 pages, ISBN 978-1-990707-00-1 (PDF).
- 12) Mark Wickert, Signals and Systems for dummies, Wiley, 2

11. Evaluation

| Activity type | 11.1 Evaluation criteria | 11.2 Evaluation methods | 11.3 Percentage of final grade |
|---------------|--------------------------|-------------------------|--------------------------------|
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| 11.4 Course | Knowledge of concepts fundamental theory of signals and systems | Control paper on a predefined date, set at the beginning semester | 10 |
| | Knowledge of how to application methods of processing of signal processing methods the achievement specific functions in electronics; | Final examination taken in exam session. Oral verification. | 20 |
| | Assessment in solving individual independent proposed problems | Final exam taken in examination session. Oral verification. | 30 |
| 11.5 Seminary/laboratory/project | Knowledge of how to comparing results experimental results with theoretical | The theoretical component is assessed when verified by calculation of the results results | 10 |
| | Assessment for understanding of notions and concepts fundamental of spectral analysis of signals | Final laboratory colloquium including a component practical component and a theoretical component | 20 |
| | Assessment in solving individual independent proposed problems | The practical component is verified by assessing the ability to measure the spectrum of a signal | 10 |
| 11.6 Passing conditions | | | |
| at least 50% of the laboratory grade at least 50% of the total grade | | | |

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)

With a solid understanding of basic principles, innovation and development are possible. Signal



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



and systems theory is one of the fundamentals that will underpin research and development for years to come. Not

is easy to teach or learn. Signals and Systems combines mathematical abstraction with concrete engineering applications.

and concrete engineering applications. Advanced mathematical knowledge and maturity in engineering engineering thinking. A Signals and Systems course needs to be designed to stimulate interest.

Students of the National University of Science and Technology - Polytechnic University of Bucharest - Faculty of Electronics,

Telecommunications and Information Technology to get them interested in applying, but at the same time to get them to appreciate the

the mathematical apparatus. The content of the course is similar to that of courses at universities in Europe and the United States.

United States with the same profile.

| Date | Course lecturer | Instructor(s) for practical activities |
|------------|--------------------------|--|
| 25.09.2025 | Prof. Dr. Simona HALUNGA | Conf. Dr. Mădălina BERCEANU, As. Drd. Maria SÎRBU-DRĂGAN |

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|-----------------------------|----------------------------------|
| Date of department approval | Head of department |
| 26.09.2025 | Conf. Dr. Serban Georgica Obreja |

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| Date of approval in the Faculty Council | Dean |
| 26.09.2025 | Prof. Dr. Mihnea Udrea |