



### 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)                    |   | Semnale și sisteme 2                                     |               |                      |                      |                   |    |
| 2.1 Course name (en)                    |   |  |               |                      |                      |                   |    |
| 2.2 Course Lecturer                     |   | Prof. Dr. Simona HALUNGA                                 |               |                      |                      |                   |    |
| 2.3 Instructor for practical activities |   | Conf. Dr. Mădălina BERCEANU, AS. drd. Maria SÎRBU-DRĂGAN |               |                      |                      |                   |    |
| 2.4 Year of studies                     | 2 | 2.5 Semester   | 2             | 2.6. Evaluation type | E                    | 2.7 Course regime | Ob |
| 2.8 Course type                         | D | 2.9 Course code  | 04.D.04.O.015 |                      | 2.10 Tipul de notare | Nota              |    |

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

|  |       |                          |    |                         |       |
|--|-------|--------------------------|----|-------------------------|-------|
| 3.1 Number of hours per week   | 4     | Out of which: 3.2 course | 2  | 3.3 seminary/laboratory | 2     |
| 3.4 Total hours in the curricula   | 56    | Out of which: 3.5 course | 28 | 3.6 seminary/laboratory | 28    |
| Distribution of time:  |       |                          |    |                         | hours |
| Study according to the manual, course support, bibliography and hand notes<br>Supplemental documentation (library, electronic access resources, in the field, etc)<br>Preparation for practical activities, homework, essays, portfolios, etc. |       |                          |    |                         | 61    |
| Tutoring   |       |                          |    |                         | 4     |
| Examinations   |       |                          |    |                         | 4     |
| Other activities (if any):   |       |                          |    |                         | 0     |
| 3.7 Total hours of individual study  | 69.00 |                          |    |                         |       |
| 3.8 Total hours per semester   | 125   |                          |    |                         |       |
| 3.9 Number of ECTS credit points   | 5     |                          |    |                         |       |

#### 4. Prerequisites (if applicable) (where applicable)

|                |   |
|----------------|---|
| 4.1 Curriculum | Completion and/or passing of the following subjects: Analysis Mathematics, Special Mathematics, Fundamentals of Electrical Engineering, Signals and Systems |
|----------------|---|



|                         |  |
|-------------------------|--|
| 4.2 Results of learning | Accumulate the following knowledge: Fourier series, Fourier transform, Fourier transform<br>Laplace transform, Z transform, characterisation of systems. Quadripoles |
|-------------------------|--|

**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, computer and blackboard.   |
| 5.2 Seminary/<br>Laboratory/Project | The laboratory will take place in a room with specific equipment, which must include: signal generator, multimeter, oscilloscope, vobulator<br>Compulsory attendance at seminar and laboratory (according to the rules of the 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*)

- methods of analysing signals and analogue systems using the Laplace transform. Stability analysis systems. Laplace method and compact method

- methods of analysis of signal-model and discrete systems using the z-transform. Response calculation systems using the z-transform. Implementation of discrete systems in direct form 1, direct form 2 and canonical form

- the diport formalisms. Characterization by matrices, Z, Y, h, g, A, B. Interconnection of the diports.

- Signal graphs. Calculation of the transfer function using signal graphs.

**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.*)

|                             |   |
|-----------------------------|---|
| <b>Specific Competences</b> | Demonstrates basic knowledge of systems analysis analogue and discrete-time systems.<br>Correlates the knowledge acquired in this course with that acquired in other courses<br>Applies in practice the knowledge acquired in the course.<br>Applies methods and tools specific to the field of systems analysis and circuits, to carry out the evaluation process of a situation encountered in practice and identifies solutions.<br>Argues and analyses coherently and correctly the context of application of knowledge of the field, using key concepts of the discipline and methodology methodology.<br>Oral and written communication in Romanian: uses specific scientific vocabulary field in order to communicate effectively, both orally and in writing. |
|-----------------------------|---|



|   |  |
|---|--|
| <p><b>Transversal (General) Competences</b></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</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.*)

|   |   |
|---|---|
| <p><b>Knowledge</b></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> <ul style="list-style-type: none"> <li>- Can use the Laplace transform to characterise analogue signals. Define stability conditions. Calculates the response to non-periodic analogue signals using the Laplace method and to periodic analogue signals by the compact method.</li> <li>-- Can use the z-transform to characterise discrete signals. Defines the conditions of stability and causality conditions. Calculates the response to non-periodic analogue signals by the Laplace method.</li> </ul> <p>Implements direct form 1, 2 and canonical filters.</p> <ul style="list-style-type: none"> <li>- is able to describe with matrix parameters a diport, is able to determine the transfer function of a system by means of signal graphs and Mason's rule</li> </ul>   |
| <p><b>Skills</b></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>Selects and groups relevant information in a given context.</p> <p>Works in teams. Produces a scientific text in the field of systems.</p> <p>Experimentally verifies identified solutions, solves practical applications. Selects sources bibliographic sources and analyses them.</p> <p>Respects the principles of academic ethics, correctly citing the bibliographical sources used.</p> <p>Demonstrates receptiveness to new learning contexts.</p> <p>Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities.</p> <p>Applies ethical/professional principles in analysing the technological impact of solutions proposed in the specialist field on the environment</p> |
| <p><b>Responsability and autonomy</b></p> | <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.</p> <p>Respects the principles of academic ethics by correctly citing the bibliographical sources used.</p> <p>Demonstrates receptiveness to new learning contexts.</p> <p>Demonstrates collaboration with other colleagues and teachers in carrying out teaching activities.</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 assimilated. This subject covers information and practical activities designed to support students in learning efforts and the development of optimal collaborative and communicative relationships in an environment

conducive to discovery learning.

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.

## 10. Contents

| COURSE  |   |           |
|---------|---|-----------|
| Chapter | Content   | No. hours |
| 1       | Bilateral and unilateral Laplace transform. Properties of the unilateral Laplace transform  | 6         |
| 2       | Laplace method for calculating the system response to analog signals non-periodic. The compact method for calculating the system envelope and at periodic analog signals  | 5         |
| 3       | Z transform for discrete non-periodic signals. Convergence domains. Properties.   | 6         |
| 4       | General methods of discrete-time systems analysis. Convolution methods, method finite difference equations and constant coefficients. Methods of analysis with Implementation of discrete systems direct form 1, 2 and canonical form | 5         |
| 5       | Analysis of quadripoles. Matrix analysis. Ideal quadripoles models. Analysis of quadripoles passive: image parameters, working parameters.  | 6         |



|   |               |
|---|---------------|
|   | <b>Total:</b> |
| <b>Bibliography:</b>  |               |
| 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, 2013  |               |

| <b>LABORATORY</b> |  |                  |
|-------------------|--|------------------|
| <b>Crt. no.</b>   | <b>Content</b>   | <b>No. hours</b> |
| 1                 | Laplace transform in Matlab programming environment                          | 2                |
| 2                 | Discrete-time signals in Matlab programming environment                      | 2                |
| 3                 | Systems response to signals using breadbord                                  | 4                |
| 4                 | Parameters of the quadripoles using the breadboard                           | 4                |
| 5                 | Final colloquium   | 2                |
|                   | <b>Total:</b>  | 14               |
| <b>SEMINARY</b>   |  |                  |
| <b>Crt. no.</b>   | <b>Content</b>   | <b>No. hours</b> |
| 1                 | Laplace transform for non-periodic analogue signals                          | 2                |
| 2                 | Laplace and compact methods for calculating the response of analogue systems | 2                |
| 3                 | Z transform for discrete non-periodic signals                                | 2                |
| 4                 | Discrete systems response. Implementation of discrete systems.               | 2                |
| 5                 | Matrix parameters of quadrupoles.  | 2                |
| 6                 | Image and working parameters of passive quadrupoles. The bisection theorem   | 2                |
| 7                 | Fluence graphs signals study   | 2                |
|                   | <b>Total:</b>  | 14               |



**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, 2013

**11. Evaluation**

| Activity type | 11.1 Evaluation criteria   | 11.2 Evaluation methods  | 11.3 Percentage of final grade |
|---------------|--|--|--------------------------------|
| 11.4 Course   | Knowledge of concepts fundamental theory of signals and systems  | Control paper on a date set at start semester                        | 10                             |
|               | Knowledge of the application of processing methods in the achievement specific functions in electronics; | Partial examination taken in examination session. Oral verification. | 20                             |
|               | Assessment in solving individual independent proposed problems   | Final exam taken in examination session. Oral verification.          | 30                             |



|  |   |   |    |
|--|---|---|----|
| 11.5<br>Seminary/laboratory/project      | Understanding of notions and concepts fundamental of spectral analysis of signals                   | Final laboratory colloquium including theoretical and practical components  | 20 |
|  | Knowledge of how to compare the experimental results with theoretical ones, deduced via computation | Assessment in solving individual independent proposed problems<br>Practical component is checked by assessment measurement skills | 10 |
|  | Assessment in solving individual independent proposed problems                                      | Practical component is checked by assessment measurement skills<br>a the spectrum of a signal                                     | 10 |
| 11.6 Passing conditions                  |   |   |    |
| 50% of the lab<br>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)**

The course presents the theory of analog and discrete systems from a signal processing perspective, but includes

the design and analysis of analog and digital filters. The first part of the course presents the theory and in the second part of the course the theory is exemplified through implementation. The course content similar to courses at universities in Europe and the United States of 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 |



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



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