**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 | **Electronic Devices, Circuits and Architectures** |
| 1.4 Domain of studies | Electronic Engineering, Telecommunications and Information Technology |
| 1.5 Cycle of studies | Bachelor/Undergraduate |
| 1.6 Programme of studies | Microelectronics, Optoelectronics and Nanotechnologies |

## 2. Date despre disciplină

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|---|---|---|---|---|---|---|---|
| 2.1 Course name (ro)<br>(en) | | | | Semnale şi sisteme 2<br>Signals of Systems 2 | | | |
| 2.2 Course Lecturer | | | | Prof. Dr. Lucian Stanciu | | | |
| 2.3 Instructor for practical activities | | | | Prof. Dr. Lucian Stanciu | | | |
| 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. | | | | | 57 |
| Tutoring | | | | | 0 |
| Examinations | | | | | 12 |
| Other activities (if any): | | | | | 0 |

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| 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)

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| 4.1 Curriculum | Calculus, Algebra, Special Mathematics, Fundamentals of Electrotechnics, Signals and Systems I |
| 4.2 Results of learning | Not the case. |

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

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| 5.1 Course | Not the case. |
| 5.2 Seminary/ Laboratory/Project | Mandatory attendance at laboratories |

**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)*

Signals are represented in discrete time using the z-transform, and the discrete Fourier transform is presented. Discrete systems and frequency domain analysis methods are studied. Various types of modulation and the principle of time multiplexing are analyzed.

Matrix analysis of diports is performed. Ideal diport models are analyzed. The interconnection of diports is presented. The image parameters and working parameters of diports are studied. The feasibility and synthesis of passive uniports and diports are presented, as well as the algebraic relations between the parts of a system function.

**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.)*

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| **Specific Competences** | Applications directly related to the concepts taught in the course are presented. The seminar aims to solve problems related to the analysis and synthesis of electrical circuits, and solving them requires knowledge of general methodologies for analysis, design, and synthesis for electrical circuits. The aim is to approach and, above all, solve the proposed problems individually and independently, which requires the ability to apply fundamental notions related to circuit and system concepts in order to carry out a continuous and systematic activity of acquiring the theory through its application. |
| **Transversal (General) Competences** | Honorable, responsible, ethical behavior. |

**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.)*

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|---|---|
| **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.*<br>- modeling a simple real-world problem involving circuit analysis and synthesis and specifying the chain of operations required to solve it; |
| **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).*<br>- implementing and demonstrating the functioning of a simple solution to a problem involving the analysis of circuits of interest and the design of diport-type circuits. |

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| **Responsability and autonomy** | *The student's capacity to autonomously and responsably apply their knowledge and skills.*<br>- |

**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.)*

The aim is for students to learn engineering methods for circuit analysis and synthesis. Specific methods for systems, modulations and diport analysis, and the main concepts related to their characterization are presented.

**10. Contents**

**COURSE**

| Chapter | Content | No. hours |
|---|---|---|
| 1 | Discrete-time Fourier transform. The Z transform. | 6 |
| 2 | General methods for analyzing discrete-time systems. Time-domain analysis methods: convolutional methods, finite difference equations with constant coefficients. Frequency-domain analysis methods: harmonic method, Z transform analysis methods. | 3 |
| 3 | Modulated signals. Definitions and classifications. Harmonic carrier modulation. Amplitude modulation. Frequency modulation. Phase modulation. Principle of frequency signal multiplexing. Amplitude pulse modulation. Principle of time multiplexing. | 4 |
| 4 | Diports analysis. Matrix analysis. Ideal diport models. Passive diport analysis: image parameters, working parameters. | 15 |
| | **Total:** | 28 |

**Bibliography:**

1) I. Constantin, "Semnale şi răspunsul circuitelor", Bucureşti, Editura BREN, 1999
2) Ad. Mateescu, N. Dumitriu, L. Stanciu, “Semnale şi sisteme. Aplicaţii în filtrarea semnalelor”, Editura Teora, 2001.
3) I. Constantin, "Semnale", Tipografia Institutului Politehnic Bucureşti, 1992
4) D. Stanomir, "Semnale şi sisteme analogice", Editura Politehnica Press, 2005.
5) D. Stanomir, "Semnale şi sisteme discrete", Editura Athena, 1997.
6) Ad. Mateescu, Al. Şerbănescu, N. Dumitriu, L. Stanciu, "Semnale, circuite şi sisteme-probleme", Editura Militară, Bucureşti, 1998.
7) I. Constantin, S. Halunga, I. Marcu, "Semnale şi sisteme-probleme", Editura Electronica 2000, Bucureşti, 2007.
8) M. Săvescu, T. Petrescu, S. Ciochină, "Semnale, circuite şi sisteme-probleme", Editura Didactică şi Pedagogică, Bucureşti,1981.
9) C. Negrescu, D. Stanomir, Semnale şi sisteme-Probleme şi soluţii, Ed. Politehnica, 2013, Bucureşti.

**LABORATORY**

| Crt. no. | Content | No. hours |
|---|---|---|

| | | |
|---|---|---|
| 1 | Laplace transform | 2 |
| 2 | Discrete signals | 2 |
| 3 | Sampling of analog signals | 2 |
| 4 | Diports – matrix parameters of diports | 4 |
| 5 | Recapitulation + Examination | 4 |
| | **Total:** | 14 |

**SEMINARY**

| **Crt. no.** | **Content** | **No. hours** |
|---|---|---|
| 1 | Z transform, Fourier transform for discrete signals. | 4 |
| 2 | General analisys methods for discrete time systems. | 4 |
| 3 | Matrix parameters of diports. | 2 |
| 4 | Image and working parameters of passive diports. | 2 |
| 5 | Symmetric diports. Atenuators. Bisection theorem. | 2 |
| | **Total:** | 14 |

**Bibliography:**

1) I. Constantin, "Semnale şi răspunsul circuitelor", Bucureşti, Editura BREN, 1999
2) Ad. Mateescu, N. Dumitriu, L. Stanciu, “Semnale şi sisteme. Aplicaţii în filtrarea semnalelor”, Editura Teora, 2001.
3) I. Constantin, "Semnale", Tipografia Institutului Politehnic Bucureşti, 1992
4) D. Stanomir, "Semnale şi sisteme analogice", Editura Politehnica Press, 2005.
5) D. Stanomir, "Semnale şi sisteme discrete", Editura Athena, 1997.
6) Ad. Mateescu, Al. Şerbănescu, N. Dumitriu, L. Stanciu, "Semnale, circuite şi sisteme-probleme", Editura Militară, Bucureşti, 1998.
7) I. Constantin, S. Halunga, I. Marcu, "Semnale şi sisteme-probleme", Editura Electronica 2000, Bucureşti, 2007.
8) M. Săvescu, T. Petrescu, S. Ciochină, "Semnale, circuite şi sisteme-probleme", Editura Didactică şi Pedagogică, Bucureşti,1981.
9) C. Negrescu, D. Stanomir, Semnale şi sisteme-Probleme şi soluţii, Ed. Politehnica, 2013, Bucureşti.

**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 concepts of circuit analysis and synthesis;<br>- knowledge of how to apply methods of analysis of analog and discrete linear and time-invariant systems in order to perform specific functions in electronics; | -The control paper taken on the date set at the beginning of the semester.<br>- Midterm and final exams taken during the exam session. | 60 |

| | | | |
|---|---|---|---|
| 11.5<br>Seminary/laboratory/project | -appreciation for individual, independent problem solving;<br>-appreciation for understanding fundamental notions and concepts of circuit analysis and synthesis;<br>- knowledge of how to measure circuit parameters and characteristics;<br>- knowledge of how to compare experimental results with theoretical ones. | - assessment in solving problems during seminar classes;<br>- assessment in solving homework problems;<br>- assessment in solving problems in a seminar test;<br><br>Final laboratory colloquium, comprising a practical component and a theoretical component. The practical component is assessed by evaluating the ability to measure circuit parameters and characteristics.<br>The theoretical component is assessed by verifying the experimental results through calculation. | 40 |
| 11.6 Passing conditions | | | |
| >=50% points. | | | |

**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)**

This course presents the theory of analog and discrete systems from the perspective of signal processing, but also includes the design of diport circuits. First, the theory is presented, followed by an implementation, which is a fascinating confirmation of the value of the theory.

| Date | Course lecturer | Instructor(s) for practical activities |
|---|---|---|
| 25.09.2025 | Prof. Dr. Lucian Stanciu | Prof. Dr. Lucian Stanciu |

| Date of department approval | Head of department |
|---|---|
| 26.09.2025 | Prof. Dr. Claudius Dan |

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