

## SYLLABUS

### 1. Data about the program of study

|                                      |                                                                                    |
|--------------------------------------|------------------------------------------------------------------------------------|
| 1.1 Institution                      | Technical University of Cluj-Napoca                                                |
| 1.2 Faculty                          | Faculty of Electronics, Telecommunications and Information Technology              |
| 1.3 Department                       | Bases of Electronics                                                               |
| 1.4 Field of study                   | Electronic Engineering, Telecommunications and Information Technologies            |
| 1.5 Cycle of study                   | Bachelor of Science                                                                |
| 1.6 Program of study / Qualification | Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer |
| 1.7 Form of education                | Full time                                                                          |
| 1.8 Subject code                     | TST-E17.00/EA-E17.00                                                               |

### 2. Data about the subject

|                                                   |                                                                                                                   |                                                                                                                |   |                |   |                      |       |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---|----------------|---|----------------------|-------|
| 2.1 Subject name                                  | Signals and Systems                                                                                               |                                                                                                                |   |                |   |                      |       |
| 2.2 Subject area                                  | Theoretical area                                                                                                  |                                                                                                                |   |                |   |                      |       |
| 2.3 Course responsible                            | Assist. Prof. Ioana SARACUT, Ph.D. - <a href="mailto:Ioana.Saracut@bel.utcluj.ro">Ioana.Saracut@bel.utcluj.ro</a> |                                                                                                                |   |                |   |                      |       |
| 2.4 Teachers in charge with seminary / laboratory | Assist. Prof. Ioana SARACUT, Ph.D. - <a href="mailto:Ioana.Saracut@bel.utcluj.ro">Ioana.Saracut@bel.utcluj.ro</a> |                                                                                                                |   |                |   |                      |       |
|                                                   | Assist. Prof. Ervin SZOPOS, Ph.D. - <a href="mailto:Erwin.Szopos@bel.utcluj.ro">Erwin.Szopos@bel.utcluj.ro</a>    |                                                                                                                |   |                |   |                      |       |
|                                                   |                                                                                                                   | Assist. Prof. Calin FARCAS, Ph.D. - <a href="mailto:Calin.Farcas@bel.utcluj.ro">Calin.Farcas@bel.utcluj.ro</a> |   |                |   |                      |       |
| 2.5 Year of Study                                 | II                                                                                                                | 2.6 Semester                                                                                                   | 3 | 2.7 Assessment | E | 2.8 Subject category | DD/DI |

### 3. Estimated total time

|                                                                                   |     |                      |    |                           |       |
|-----------------------------------------------------------------------------------|-----|----------------------|----|---------------------------|-------|
| 3.1 Number of hours per week                                                      | 4   | of which: 3.2 course | 4  | 3.3 seminary / laboratory | 2     |
| 3.4 Total hours in the curriculum                                                 | 56  | of which: 3.5 course | 28 | 3.6 seminary / laboratory | 28    |
| Distribution of time                                                              |     |                      |    |                           | hours |
| Manual, lecture material and notes, bibliography                                  |     |                      |    |                           | 28    |
| Supplementary study in the library, online specialized platforms and in the field |     |                      |    |                           | 8     |
| Preparation for seminars/laboratory works, homework, reports, portfolios, essays  |     |                      |    |                           | 28    |
| Tutoring                                                                          |     |                      |    |                           | 3     |
| Exams and tests                                                                   |     |                      |    |                           | 3     |
| Other activities                                                                  |     |                      |    |                           |       |
| 3.7 Total hours of individual study                                               | 69  |                      |    |                           |       |
| 3.8 Total hours per semester                                                      | 125 |                      |    |                           |       |
| 3.9 Number of credit points                                                       | 5   |                      |    |                           |       |

### 4. Pre-requisites (where appropriate)

|                |                                                                                                                                                                                              |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1 Curriculum | Knowledge acquired in mathematics course and circuit theory course.                                                                                                                          |
| 4.2 Competence | Mathematical notions: complex numbers, Laplace transform, trigonometry, Fourier transform, Laplace transform, computation of simple integrals. Relations and theorems for electric circuits. |

## 5. Requirements (where appropriate)

|                                           |                           |
|-------------------------------------------|---------------------------|
| 5.1 for the course                        | Amphitheatre, Cluj-Napoca |
| 5.2 for the seminars / laboratory classes | Laboratory, Cluj-Napoca   |

## 6. Specific competences

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Professional competences | <p>C1. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology</p> <p>C2. Applying the basic methods for the acquisition and processing of signals</p> <p>C3. Application of the basic knowledge, concepts and methods regarding the architecture of computer systems, microprocessors, microcontrollers, languages and programming techniques</p> <p>C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information</p> |
| Transversal competences  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## 7. Discipline objectives (as results from the key competences gained)

|                         |                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.1 General objective   | The development of the skills regarding the study of signals and systems.                                                                                                                                                                                                                                                                           |
| 7.2 Specific objectives | <ol style="list-style-type: none"> <li>1. Knowledge and understanding of basic approaches regarding signals and systems.</li> <li>2. Development of skills and abilities for the analysis of time-continuous signals.</li> <li>3. Development of skills and abilities for the analysis of time-continuous linear time-invariant systems.</li> </ol> |

## 8. Contents

| 8.1 Lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Teaching Methods                                                                        | Remarks                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------------------|
| <ol style="list-style-type: none"> <li>1. Introduction into Signals and Systems. Classification of signals. Basic operations of signals. Harmonic signals.</li> <li>2. Continuous time periodic signals. Non-harmonic signals. Fourier series. Properties of the Fourier series.</li> <li>3. Continuous-time aperiodic signals. Fourier transform.</li> <li>4. Properties of the Fourier transform. Ideal filters.</li> <li>5. Classification of systems. Description of linear invariant time systems: differential equation, impulse response, transfer function. Laplace transform.</li> <li>6. Description of linear invariant time systems: step response, frequency response.</li> </ol> | Presentation, exemplifications, problem presentation, case study, formative evaluation. | Use of the blackboard. |

|                                                                                                                                    |                                                                                                                              |                                                  |
|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 7. Applications of LTI systems.                                                                                                    |                                                                                                                              |                                                  |
| 8. Bode plots.                                                                                                                     |                                                                                                                              |                                                  |
| 9. Discrete-time periodic signals. Discrete-time Fourier series. Discrete-time aperiodic signals. Discrete-time Fourier transform. |                                                                                                                              |                                                  |
| 10. Description of linear invariant time-discrete systems: difference equation, unit impulse response, transfer function.          |                                                                                                                              |                                                  |
| 11. Signals sampling. Sampling theorem. Spectral analysis of sampled signals. Reconstruction of time-continuous signals.           |                                                                                                                              |                                                  |
| 12. Amplitude modulation. Special amplitude modulation procedures.                                                                 |                                                                                                                              |                                                  |
| 13. Position and frequency modulation.                                                                                             |                                                                                                                              |                                                  |
| 14. Review. Preparation for examination.                                                                                           |                                                                                                                              |                                                  |
| <b>Bibliography</b>                                                                                                                |                                                                                                                              |                                                  |
| The web page of the course: <a href="http://www.bel.utcluj.ro/scs/">http://www.bel.utcluj.ro/scs/</a>                              |                                                                                                                              |                                                  |
| <b>8.2 Seminary classes</b>                                                                                                        | <b>Teaching Methods</b>                                                                                                      | <b>Remarks</b>                                   |
| 1. Introduction into signal theory. Complex numbers. Sinusoidal signals.                                                           | Solving of problems and review of some theoretical aspects.<br>Didactic and experimental proof, didactic exercise, team work | Use of the blackboard.<br>Use of Digilent board. |
| 2. Spectra of periodic time-continuous signals-                                                                                    |                                                                                                                              |                                                  |
| 3. Spectra of aperiodic time-continuous signals.                                                                                   |                                                                                                                              |                                                  |
| 4. Linear invariant systems.                                                                                                       |                                                                                                                              |                                                  |
| 5. Bode plots.                                                                                                                     |                                                                                                                              |                                                  |
| 6. Spectra of discrete-time signals. Sampled signals.                                                                              |                                                                                                                              |                                                  |
| 7. Modulated signals.                                                                                                              |                                                                                                                              |                                                  |
| <b>Laboratory classes</b>                                                                                                          |                                                                                                                              |                                                  |
| 1. Introduction of the Analog Discovery Board.                                                                                     |                                                                                                                              |                                                  |
| 2. Spectrum of periodic time-continuous signals.                                                                                   |                                                                                                                              |                                                  |
| 3. Spectrum of the periodic square wave.                                                                                           |                                                                                                                              |                                                  |
| 4. First order systems.                                                                                                            |                                                                                                                              |                                                  |
| 5. Sampled signals.                                                                                                                |                                                                                                                              |                                                  |
| 6. Amplitude and frequency modulated signals.                                                                                      |                                                                                                                              |                                                  |
| 7. Lab recovery of laboratory activity.                                                                                            |                                                                                                                              |                                                  |
| <b>Bibliography</b>                                                                                                                |                                                                                                                              |                                                  |
| Weekly homework problems, submitted by email.                                                                                      |                                                                                                                              |                                                  |
| The web page of the course: <a href="http://www.bel.utcluj.ro/scs/">http://www.bel.utcluj.ro/scs/</a>                              |                                                                                                                              |                                                  |

## 9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field.

The discipline content and the acquired skills are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

## 10. Evaluations

| Activity type                        | 10.1 Evaluation criteria                                             | 10.2 Evaluation methods                   | 10.3 Weight in the final grade |
|--------------------------------------|----------------------------------------------------------------------|-------------------------------------------|--------------------------------|
| 10.4 Lecture                         | The level of acquired theoretical knowledge                          | 2 written tests (30p) – TC                | Max 30%                        |
| 10.5 Laboratory                      | The level of acquired skills and abilities                           | Evaluation during the semester (10p) – TL | Max 10%                        |
| Exam                                 | The level of acquired theoretical knowledge, of skills and abilities | Written examination (60p) – E             | Max 60%                        |
| Final mark = (TC+TL+E) / 10          |                                                                      |                                           |                                |
| 10.6 Minimum standard of performance |                                                                      |                                           |                                |
| TC+TL > 20p and E > 25p              |                                                                      |                                           |                                |

| Date of filling in: | Responsible  | Title First name SURNAME           | Signature |
|---------------------|--------------|------------------------------------|-----------|
| 16.06.2025          | Course       | Assist. Prof. Ioana SARACUT, Ph.D. |           |
|                     | Applications | Assist. Prof. Ioana SARACUT, Ph.D. |           |
|                     |              | Assist. Prof. Ervin SZOPOS, Ph.D.  |           |
|                     |              | Assist. Prof. Calin FARCAS, Ph.D.  |           |

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|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Date of approval in the Council of the Communications Department<br>18.06.2025                                             | Head of Communications Department<br>Prof. Virgil DOBROTA, Ph.D. |
| Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology<br>25.06.2025 | Dean<br>Prof. Ovidiu POP, Ph.D.                                  |