SYLLABUS

1. Data about the study program

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Applied Electronics / Engineer
1.7 Form of education	Full time
1.8 Subject code	17.00

2. Data about the subject

2.1 Subject name	Signals and Systems						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assist. Prof. Ioana Sărăcuţ, PhD Eng. Ioana.Saracut@bel.utcluj.ro						
2.4 Teachers in charge with seminary / laboratory	Assist. Prof. Ioana Sărăcuţ, PhD Eng. Ioana.Saracut@bel.utcluj.ro Assist. Prof. Erwin Szopos, PhD Eng. Erwin.Szopos@bel.utcluj.ro Teach.Assist. Călin Fărcaş, PhD Eng. CalinFarcas@bel.utcluj.ro						
2.5 Year of Study	II	2.6 Semester	1	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	30
Supplementary study in the library, online specialized platforms and in the field	15
Preparation for seminaries/laboratory works, homework, reports, portfolios, essays	16
Tutoring	5
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 seminaries / laboratory classes	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology • C1.1 Recognizing and describing concepts that are specific to the fields of calculability, complexity, programming paradigms, and modeling computational and communication systems • C1.5 Providing a theoretical background for the characteristics of the designed systems C2 Applying the basic methods for signal acquisition and processing • C2.1 Temporal, spectral and statistical characterization of signals • C2.2 Explaining and interpreting the methods of acquisition and processing of signals • C2.3 Use of simulation environments for signal analysis and processing • C2.4 Use of the specific method and tools for signal analysis C3 Application of the basic knowledge, concepts and methods regarding the architecture of computing systems, microprocessors, microcontrollers, programming languages and techniques • C3.4 Development of programs for a general and / or specific programming language, starting from the specification of the requirements and until the execution, debugging and interpretation of the results in correlation with the processor used • C3.5 Projects involving hardware (processors) and software (programming) components C4. Design and use of low complexity hardware and software applications specific to the applied electronics • C4.1 Defining the concepts, principles and methods used in the fields: computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures • C4.2 Explanation and interpretation of the specific requirements of the hardware and software structures in the fields: computer programming, high-level and specific languages, CAD techniques for making electronic modules, microcontrollers, computer systems architecture, programmable electronic systems, graphics, reconfigurable hardware architectures
Cross 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	**1.** Knowledge and understanding of basic approaches regarding signals and systems. **2.** Development of skills and abilities for the analysis of time-continuous signals.

	3. Development of skills and abilities for the analysis of time-continuous linear time-invariant systems.

8. Contents

8.1 Lecture	**Teaching Methods**	**Remarks**
1. Introduction into Signals and Systems. Classification of signals. Basic operations of signals. Harmonic signals.	Presentation, exemplifications, problem presentation, case study, formative evaluation.	Use of the blackboard.
2. Continuous time periodic signals. Non-harmonic signals. Fourier series. Properties of the Fourier series.		
3. Continuous-time aperiodic signals. Fourier transform.		
4. Properties of the Fourier transform. Ideal filters.		
5. Classification of systems. Description of linear invariant time systems: differential equation, impulse response, transfer function. Laplace transform.		
6. Description of linear invariant time systems: step response, frequency response.		
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.		

Bibliography

1. Alan V. Oppenheim, Alan S. Willsky - "Signals and Systems (Second Edition)", Pearson Education, Inc. Publishing as Prantice Hall, 1997
2. Raymond A. DeCarlo - "Circuit Analysis: Time Domain, Phasor, and Laplace Transform Approaches ", Oxford University Press, 2001
3. Luis F. Chaparro - "Signals and Systems using MATLAB", Academic Press, 2014

The web page of the course: http://www.bel.utcluj.ro/scs/

8.2 Seminary classes	**Teaching Methods**	**Remarks**
1. Introduction into signal theory. Complex numbers. Sinusoidal signals.	Solving of problems and review of some theoretical aspects. Didactic and experimenta	Use of the blackboard. 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.		
Laboratory classes		
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.		

Bibliography

1. Alan V. Oppenheim, Alan S. Willsky - "Signals and Systems (Second Edition)", Pearson Education, Inc. Publishing as Prantice Hall, 1997
2. Raymond A. DeCarlo - "Circuit Analysis: Time Domain, Phasor, and Laplace Transform Approaches ", Oxford University Press, 2001
3. Luis F. Chaparro - "Signals and Systems using MATLAB", Academic Press, 2014

Weekly homework problems, submitted by email.
The web page of the course: http://www.bel.utcluj.ro/scs/

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 organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job, the expectations of the national organization for quality assurance (ARACIS).

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			

Quality level:
Minimum knowledge:

- Knowledge and understanding of basic approaches regarding signals and systems
- Description of linear invariant time systems: step response, frequency response
- Signals sampling. Sampling theorem. Spectral analysis of sampled signals. Reconstruction of time-continuous signals

Minimum competences:

- Development of skills and abilities for the analysis of time-continuous signals.
- Development of skills and abilities for the analysis of time-continuous linear time-invariant systems

Quantitative level:

- TC+TL > 20p and E > 25p

Date of filling in:	**Teachers**		**Signature**
29.09.2019	Course	Assist. Prof. Ioana Sărăcuţ, PhD Eng.	
	Applications	Assist. Prof. Ioana Sărăcuţ, PhD Eng.	
		Assist. Prof. Erwin Szopos, PhD Eng.	
		Teach.Assist. Călin Fărcaş, PhD Eng.	

Date of approval in the Department of Bases of Electronics
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Head of department
Prof. Sorin HINTEA, PhD Eng.

Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology
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Dean
Prof. Gabriel OLTEAN, PhD Eng.