SYLLABUS

1. Information about the program

1.1 Higher education institution	UNIVERSITY POLITEHNICA OF TIMISOARA
1.2 Faculty[1]/ Department [2]	ELECTRONICS, TELECOMUNICATON AND INFORMATION TECHNOLOGIES/Communications
1.3 Field of study (name/code[3])	ELECTRONIC ENGINEERING, TELECOMUNICATION AND INFORMATION TECHNOLOGIES
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	TST-ENG/20/20/10/100/10/TST-ENG

2. Information about the discipline

2.1 Name of discipline/ formative category[4]			Digital Signal Processing/DD				
2.2 Coordinator (holder) of course activities			Georgiana Morar				
2.3 Coordinator (holder) of applied activities[5]			Georgiana Morar				
2.4 Year of study[6]	2	**2.5** Semester	4	**2.6** Type of evaluation	E	**2.7** Regime of discipline[7]	DI

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [8]

3.1 Number of fully assisted hours / week	4 of which:	**3.2** course	2	**3.3** seminar / laboratory / project	0/2/0
3.1* Total number of fully assisted hours / semester	56 of which:	**3.2*** course	28	**3.3*** seminar / laboratory / project	0/28/0
3.4 Number of hours partially assisted / week	0 of which:	**3.5** training	0	**3.6** hours for diploma project elaboration	0
3.4* Total number of hours partially assisted / semester	0 of which:	**3.5*** training	0	**3.6*** hours for diploma project elaboration	0
3.7 Number of hours of unassisted activities / week	4.93 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			1.5
		hours of individual study after manual, course support, bibliography and notes			1.93
		training seminars / laboratories, homework and papers, portfolios and essays			1.5
3.7* Number of hours of unassisted activities / semester	69 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			21
		hours of individual study after manual, course support, bibliography and notes			27
		training seminars / laboratories, homework and papers, portfolios and essays			21
3.8 Total hours / week [9]	8.93				
3.8* Total hours /semester	125				
3.9 Number of credits	5				

4. **Prerequisites** (where applicable)

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[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).
[8] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

4.1 Curriculum	• Signals and Systems, Mathematics I-IV, Electrical Circuits, Introduction to Computer Programming, Physics, Electronic devices, Electrical and Electronic Measurements
4.2 Competencies	• Electronic systems analysis , Electronic systems synthesis, Analog and digital filter design

5. Conditions (where applicable)

5.1 of the course	• Presentations from PowerPoint slides published on the Virtual Campus
5.2 to conduct practical activities	• Electronic instruments, PCs, video projector, solving homework on time, solving tests in class

6. Specific competencies acquired through this discipline

Specific competencies	• Analysis of digital and analog systems using the Z-transform and the Laplace transform, respectively, Sampling of signals and the spectrum of the sampled signal, Approximation of continuous-time systems by discrete-time systems, Continuous-wave modulation, Stability of systems with negative feedback
Professional competencies ascribed to the specific competencies	• Use of fundamentals in terms of devices, circuits, systems, instrumentation and electronics technology. • Application of basic methods for signal acquisition and processing. •
Transversal competencies ascribed to the specific competencies	• Methodical analysis of field-related problems aimed at identifying acknowledged solutions, thus ensuring the accomplishment of professional tasks. • Definition of activity stages and their distribution to subordinates in terms of responsabilities, providing effective exchange of information and interpersonal communication. • Adaptation to new technologies, professional and personal development through continuous training, using printed documentation sources, specialized software and electronic resources in Romanian and at least one foreign language.

7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	• This course is frequently found in electrical engineering curricula, the concepts and techniques that form the core of the subject are of fundamental importance in all engineering disciplines. Our approach has been guided by the continuing developments in technologies for signal and system design and implementation, which made it increasingly important for a student to have equal familiarity with techniques suitable for analyzing and synthesizing both continuous-time and discrete-time systems
7.2 Specific objectives	• Specific objectives are to teach students to solve a linear constant coefficient differential (difference) equation using Laplace transform techniques (for continuous-time systems) or using z-transform (for discrete-time systems), to understand the application of Fourier analysis to ideal filtering, amplitude modulation and sampling. They will be able to process continuous-time signals by first sampling and then processing the sampled signal in discrete-time. The students will be able capable of deciding whether a system is BIBO stable or not. They will learn if the system becomes stable when included in a linear feedback loop and what are the applications for this. Finally, they will develop basic problem solving skills and become familiar with formulating a mathematical problem from a general problem statement. They will be able to solve linear systems and signal problems with MATLAB programming and will be able to use basic mathematics including calculus, complex variables and algebra for the analysis and design of linear time invariant systems used in engineering.

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
1. The Laplace transform: The Region of Convergence for Laplace Transforms, Properties of the Laplace Transform, Analysis and Characterization of LTI Systems Using the Laplace Transform.	5	
2. Ideal Filtering, lowpass, highpass, bandpass, bandstop filters	1	
3. Sampling : Representation of a Continuous-Time Signal by Its Samples. The Sampling Theorem. Reconstruction of a Signal from Its Samples using Interpolation. Sampling of Discrete-Time Signals	5	
4. The z transform: The Region of Convergence for the z-Transform, Properties of the z-Transform, Analysis and Characterization of LTI Systems Using the z- Transform.	4	
5. Approximation of continuous time systems with discrete time systems.	4	
6. Continuous-wave modulation: Complex Exponential and Sinusoidal Amplitude Modulation, Pulse Amplitude Modulation, Sinusoidal Frequency Modulation, Phase Modulation.	5	
7. Stability, Linear feedback systems Some Applications and Consequences of Feedback, The Nyquist Stability Criterion, Gain and Phase Margins	4	

Bibliography [12]

1. Corina Nafornita, "Signals and Systems, vol. 1", Politehnica Publishing House, 2009, ISBN 978-973-625-942-5 (ISBN 978-973-625-944-9 vol I), published in English.
2. Corina Nafornita, Alexandru Isar, Signals and systems. Vol. 2., 2016, Politehnica Publishing House, ISBN 978-973-625-942-5 (ISBN 978-606-35-0072-5 vol II), published in English.
3. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, Second Edition, Prentice Hall, Upper Saddle River, New Jersey, 1997, ISBN 0-13-814757-4.
4. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd edition, John Wiley & Sons, 2003
5. Michael J. Roberts, Signals and systems : Analysis using transform methods and MATLAB, McGraw Hill, 2004
6. Hwei Hsu, Schaum's Outline of Signals and Systems, 3rd Edition (Schaum's Outline Series), 2013.
7. Monson Hayes, Digital Signal processing, 2nd edition, McGraw Hill, Schaum's outlines, 2011.

8.2 Applied activities [13]	Number of hours	Teaching methods
Laboratory 1 Laplace transform 2 Sampling of signals 3 Z Transform 4 Approximation of analogic systems with discrete-time systems 5 Continuous-wave modulation 6 Statistical characterization of stationary ergodic random signals 7 Stability of feedback systems 8 Audio signal identification	28	Presentation, Measurements, Simulations, Discussion

[10] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".
[11] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).
[12] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.
[13] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".

Bibliography [14] [15] Laboratory online at pe Virtual Campus Hwei Hsu, Schaum's Outline of Signals and Systems, 3rd Edition (Schaum's Outline Series), 2013 Monson Hayes, Digital Signal processing, 2nd edition, McGraw Hill, Schaum's outlines		

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- The Signal Processing course is fundamental in the study of electronics and telecommunications. Similar courses taught at universities abroad are:
- Signals and Systems, MIT, http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/ https://sigproc.mit.edu/fall22
- Deepa Kundur, Signals and Systems, University of Toronto, http://www.comm.utoronto.ca/~dkundur/course/signals-and-systems/
- Deepa Kundur, ECE 362 Digital Signal Processing, University of Toronto, http://www.comm.utoronto.ca/~dkundur/course/ece-362-digital-signal-processing/
- Signals and Systems, UC Berkeley, http://ptolemy.eecs.berkeley.edu/eecs20/

10. Evaluation

Type of activity	**10.1** Evaluation criteria [16]	**10.2** Evaluation methods	**10.3** Share of the final grade
10.4 Course	Minimum mark 5	Written exam	2/3
10.5 Applied activities	**S:**		
	L: Minimum mark 5	Test/ project	1/3
	P[17]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [18])			
• Minimum mark 5 is obtained for activity mark minimum 5 and exam mark minimum 5 with mark = 1/3 * activity + 2/3 *exam			

Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
20.06.2023		
Head of Department (signature)	**Date of approval in the Faculty Council** [19]	**Dean (signature)**
	14.09.2023	

[14] At least one title must belong to the discipline team.
[15] At least one title must belong to the staff teaching the discipline.
[16] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)
[17] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.
[18] It will not explain how the promotion mark is awarded.
[19] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.