SYLLABUS[1]

1. Information about the program

1.1 Higher education institution	Universitatea Politehnica Timisoara
1.2 Faculty[2] / Department[3]	Electronics and Telecommunications/Communications
1.3 Chair	▬
1.4 Field of study (name/code[4])	
1.5 Study cycle	L
1.6 Study program (name/code)/Qualification	

2. Information about the discipline

2.1 Name of discipline		Signal Processing					
2.2 Coordinator (holder) of course activities		Corina Nafornita					
2.3 Coordinator (holder) of applied activities [5]		Corina Nafornita					
2.4 Year of study[6]	II	**2.5** Semester	2	**2.6** Type of evaluation	E	**2.7** Type of discipline	Fundamental

3. Total estimated time (hours / semester of didactic activities)

3.1 No. of hrs. / week	4 , of which:	**3.2** course	2	**3.3** seminar/laboratory/ project/training	0/2/0/0
3.4 Total no. of hrs. in the education curricula	56 , of which:	**3.5** course	28	**3.6** applied activities	28

3.7 Distribution of time for individual activities related to the discipline	hrs.
Study using a manual, course materials, bibliography and lecture notes	20
Additional documentation in the library, on specialized electronic platforms and on the field	7.5
Preparation for seminars / laboratories, homeworks, assignments, portfolios, and essays	20
Tutoring	7
Examinations	2.5
Other activities	
Total hrs. of individual activities	57

3.8 Total hrs. / semester[7]	113
3.9 No. of credits	5

4. Prerequisites (where applicable)

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 Communications dept. page, http://shannon.etc.upt.ro/teaching/
5.2 to conduct practical activities	• There are proposed homework subjects, at each lab, and the students are examined with the help of test papers.

6. Specific competencies acquired

Professional competencies[8]	• C1 Utilizarea elementelor fundamentale referitoare la dispozitivele, circuitele, sistemele, instrumentatia si tehnologia electronica; C2 Aplicarea metodelor de baza pentru achizitia si prelucrarea semnalelor. C4 Conceperea, implementarea i operarea serviciilor de date, voce, video, multimedia, bazate pe în elegerea i aplicarea no iunilor fundamentale din domeniul comunica iilor i transmisiunii informa iei
Transversal competencies	• CT1 Analiza metodica a problemelor întâlnite în activitate, identificând elementele pentru care exista solutii consacrate, asigurând astfel îndeplinirea sarcinilor profesionale; CT2 Definirea activit ilor pe etape i repartizarea acestora subordona ilor cu explicarea complet a îndatoririlor, în func ie de nivelurile ierarhice, asigurând schimbul eficient de informa ii i comunicarea interuman ; CT3 Adaptarea la noile tehnologii, dezvoltarea profesionala si personala, prin formare continua folosind surse de documentare tiparite, software specializat si resurse electronice în limba româna si, cel putin, întro limba de circulatie internationala.

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

7.1 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

8.1 Course	No. of hours	Teaching methods
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	Lecture, Presentation, Discussion
2. Ideal Filtering, lowpass, highpass, bandpass, bandstop filters	1	Lecture, Presentation, Discussion
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	Lecture, Presentation, Discussion
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	Lecture, Presentation, Discussion
5. Approximation of continuous time systems with discrete time systems.	4	Lecture, Presentation, Discussion
6. Continuous-wave modulation: Complex Exponential and Sinusoidal Amplitude Modulation, Pulse Amplitude Modulation, Sinusoidal Frequency Modulation, Phase Modulation.	5	Lecture, Presentation, Discussion
7. Stability, Linear feedback systems Some Applications and Consequences of Feedback, The Nyquist Stability Criterion, Gain and Phase Margins	4	

Bibliography[9]   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.

[9] At least one title must belong to the department staff teaching the discipline, and at least 3 titles must refer to national and international works relevant for the discipline, and which can be found in the Politehnica University Library.

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[10]	No. of hours	Teaching methods
1 Sampling of signals 2 Continuous-wave modulation 3 Statistical characterization of stationary ergodic random signals 4 Spectral analysis of random signals 5 Laplace transform 6 Z Transform 7 Approximation of analogic systems with discrete-time systems 8 Stability of feedback systems	28	Presentation, Measurements, Simulations, Discussion

Bibliography [11]   Laboratory online at http://shannon.etc.upt.ro/teaching/sp-pi

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/

- Deepa Kundur, Signals and Systems, University of Toronto, http://www.comm.utoronto.ca/~dkundur/course/signals-and-systems/

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[10] The types of applied activities are those specified in footnote 5. If the discipline contains several types of applied activities, then these will be written consecutively in the lines of the table below. The type of activity will be written in a distinct line, as „Seminar:", „Laboratory:", „Project:" and/or „Practice/Training:".
[11] At least one title must belong to the staff teaching the discipline.

- 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		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		Tests, Report on each laboratory, Homework	1/3
	P:			
	Pr:			
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified)				
- 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)
19.12.2016		
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Head of Department (signature)	**Date of approval in the Faculty Council**[12]	**Dean** (signature)
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