UNIVERSIDADE FEDERAL DO CEARÁ

FEDERAL UNIVERSITY OF CEARÁ
OFFICE OF THE VICE PROVOST FOR UNDERGRADUATION (PROGRAD)
COORDINATION FOR PROJECT AND CURRICULUM DEVELOPMENT
CURRICULUM DEVELOPMENT DIVISION

1. Academic unit offering the curricular component (Faculty, Center, Institute, Campus)**:**

Center of Technology

2. Department offering the curricular component (when applicable)**:**

Teleinformatics Engineering Department

3. Undergraduate course(s) offering the curricular component

Code of the Course	Name of the Course	Course Degree[1]	Curriculum (Year/ Semester)	Nature of the Component[2]	Semester of Offer[3]	Habilitation[4]
91	Telecommunications Engineering	Bachelor	2015.1	Mandatory	04	-

4. Name of the curricular component:
Signals and Systems

5. Code of the curricular component (filled by PROGRAD)**:**
TI0116

6. Prerequisites — No ( ) — Yes (x)

Code	Name of the curricular component / activity
CB0801	Introduction to the Ordinary Differential Equations

7. Corequisite — No (x) — Yes ( )

Code	Name of the curricular component / activity

8. Equivalences — No ( ) — Yes (x)

Code	Name of the curricular component / activity
TI0047	Signals and Systems

9. Day period of the curricular component (more than one option can be selected)**:**
(x) Morning (x) Afternoon (x) Night

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1 **Fill with *Bachelor (Engineer), Licenciate,* or *Technologist.***
2 **Fill with *Mandatory, Optional,* or *Elective.***
3 **Fill when mandatory.**
4 **When elective, fill with the habilitation or emphasis to which the curricular component is linked.**

10. Regime of the curricular component:

(x) Semester ( ) Yearly ( ) Modular

11. Justificatory for the creation/regulamentation of this curricular component

The digital signal processing techniques in their many applications (meteorology, remote sensing, telecommunications, signal processing, etc.) have been an important object of study and contributed to the scientific and technologic progress. Thus, it becomes necessary that the contents studied in this course be present in the formation of professionals that work in the many different areas related to electrical engineering and, in particular, of telecommunications engineering.

12. Objectives fo the curricular component:

The student should become capable of recognizing the main concepts involved in the characterization of signals and in the modeling of continuos- and discrite-time systems, as well as be capable of using adequately mathematical models that describe real physical signals and systems. The student should be capable of using mathematical tools to analyze the properties of linear time-invariant systems in the time and frequency domains.

13. Syllabus:

Introduction to signals and systems; LTI systems; Fourier series; Continuous-time Fourier transform; Discrete-time Fourier transform; system characterization in time and frequency domains.

14. Program:

1. **Introduction to signals and systems**: mathematical representation of continuous and discrete signals, periodic and aperiodic signals. Basic continuous and discrete signals. System properties.
2. **LTI systems**: continous and discrete LTI systems, signal representation in terms of impulses, impulse response, convolution integral for continuou-time LTI systems, convolution sum for discrete-time LTI systems. LTI system properties. Systems described by differential equations and by difference equations. Modeling of electrical, mechanical and thermical systems.
3. **Fourier series**: analogy between vectors and signals, examples of orthogonal functions , Fourier series representation of a periodic function, Fourier complex spectrum.
4. **Continuous-time Fourier transform**: representation of aperiodic signals using FT, convergence, FT transform properties for continuous-time signals, inverse transform, systems described by linear differential equations with constant coefficients.
5. **Discrete-time Fourier transform**: representation of aperiodic signals using FT, convergence, FT transform properties for discrete-time signals, inverse transform, systems described by difference equations with constant coefficients.
6. **Time- and frequency-domain characterization of systems**: amplitude and phase representation of the FT, amplitude and phase representation of the frequency response of LTI systems, linear phase, nonlinear phase, group delay, representation using the logarithm of the amplitude.

15. Workload description				
Number of Weeks: 16	**Number of Credits:** 04	**Total Workload in Hours:** 64	**Theory Workload in Hours:** 64	**Practice Workload in Hours:** -

16. Basic bibliography:

1- Oppenheim, A.V.; Willsky; A.S., Hamid, S., Signals and Systems, Prentice-Hall, 2nd edition, 1996.

2- Haykin, S., Van Veen, B. Signals and Systems, 2nd edition, Wiley, 2002.

3- Lathi, B.P., Linear Systems and Signals, 2nd edition, Oxford University Press, 2009.

17. Complementary bibliography:

1- Baher, H., Analog & Signal Processing, John Wiley & Sons, 1990.

2- Buck, J.R., Daniel, M.M., Singer, A.C., Computer Explorations in Signals and Systems Using MATLAB, 2nd edition, Prentice-Hall, 2001.

3- Cooper, G.R., Continuous and Discrete Signals and Systems Analysis, Oxford University Press, 3rd edition, 1995.

4- Embree, Paul M., Danneli, D., C++ Algorithms for Digital Signal Processing, Prentice Hall, 1998.

5- Brigham, E. O., The Fast Fourier Transform and Its Applications, Prentice-Hall, 1988.