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	06	-

4. Name of the curricular component:
Introduction to Information Theory

5. Code of the curricular component (filled by PROGRAD)**:**
TI0056

6. Prerequisites	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0120	Communication Principles

7. Corequisite	No (x)	Yes ( )	
		Code	Name of the curricular component / activity

8. Equivalences	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0019	Introduction to Information and Coding Theory

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

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

Information theory uses as a tool the mathematical modeling and uses the analysis of the communication systems, to define limits in the behavior and performance of the same.

12. Objectives fo the curricular component:

To study fundamental and limiting concepts in Information Theory in the context of digital communications systems and in more general aspects of the design of information systems.

13. Syllabus:

Uncertainty, information and entropy. Source coding theorem. Huffman encoding. Discrete channel without memory. Mutual information. Channel capacity. Channel coding theorem. Differential entropy and mutual information. Channel capacity theorem.

14. Program:

1. **Introduction:** sources and signals. Basic operations in digital systems. Channels for digital communications.
2. **Uncertainty, information and entropy:** definition of information and entropy; some properties of entropy. Discrete source without extended memory. Mutual information, differential entropy, joint entropy and relative entropy.
3. **Source coding theorem:** coding efficiency. Variance of the mean word length. Prefix coding. Inequality of Kraft-McMillan.
4. **Huffman coding**
5. **Discrete channel without memory:** channel classification. Discrete channels without memory. Mean symbol error probability. Notions of channels with memory.
6. **Channel capacity.**
7. **Channel coding theorem:** performance limits, application to symmetric binary channel. Linear block codes.
8. **Channel capacity theorem:** Gaussian signaling, performance limiting.
9. **Optimization metrics:** optimization by measure of information.

15. Workload description

Number of Weeks:	Number of Credits:	Total Workload in Hours:	Theory Workload in Hours:	Practice Workload in Hours:
16	04	64	64	-

16. Basic bibliography:

1- Haykin Simon, Communication Systems, 4th edition, John Wiley & Sons, 2001.

17. Complementary bibliography:

1- Haykin Simon, Digital Communication, John Wiley & Sons, 1988.

2- Lin, S. and Costello D. Jr., “Error Control Coding: Fundamentals and Applications”, Prentice-Hall, N.Y., 1983.