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	03	-

4. Name of the curricular component:
Stochastic Processes

5. Code of the curricular component (filled by PROGRAD)**:**
TI0112

6. Prerequisites	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		CB0664	Fundamentals of Calculus
		TI0111	Statistics for Engineers

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

8. Equivalences	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0048	Probabilistic Models for Engineers

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

The majority of the telecommunications engineering areas has as scientific, technological and professional foundation the observation, understanding, modeling, control, and application of stochastic events. This implies a deep and solid formation on probabilistic concepts applied to signals, telecommunication networks and systems, as well as statistical measurements, building the basis for the study of stochastic processes widely used in the area. Random variables that represent these phenomena and / or events can originate from observations of processes that vary as a function of the time, which are termed random or stochastic processes. This implies a deep and solid formation on stochastic process concepts applied to signals, telecommunication networks and systems often present in the formation of an engineer.

12. Objectives fo the curricular component:

Provide to the student the fundamentals, understanding, and domain over the usage of stochastic process models and over the statistical measures of functions of continuous and discrete random variables with temporal variation with the context of engineering.

13. Syllabus:

Stochastic processes: definitions. Stationary and ergodic processes. Poisson processes. Markov chains and introduction to queueing theory; spectral analysis of stochastic processes.

14. Program:

1. **Stochastic processes**: definition, realizations, ensemble, characterization, k-th order pdf, moments. Poisson processes and autoregressive processes. Applications.

2. **Stationary and ergodic processes**: wide- and strict-sense stationariety, ergodicity, independency among stochastic processes, autocorrelation and crosscorrelation functions, correlation coefficient, energy, power. Poisson processes, Markovian processes, Gaussian processes, Wiener processes, autoregressive processes.

3. **Markov chains and introduction to queueing theory**: Definition, state transition probability matrix, Chapman-Kolmogorov equation, probability distributions, state classification, absorption probability, stationary and limit distributions, queueing theory, Markovian queues, M/M/1 queues, M/M/m queues, M/M/1/K queues.

4. **Spectral analysis of stochastic processes**: power spectrum density, Wiener-Khinchine equation, white noise, periodogram. Discrete Fourier Transform, Shannon's sampling theorem and power spectrum density estimation using the periodogram method.

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- Steven Kay. Intuitive Probability and Random Processes using MATLAB, Springer, 2006.

2- Alberto Leon-Garcia. Probability and Random Processes for Electrical Bacheloring. Addison-Wesley, 2nd edition, 1994.

3- Athanasios Papoulis. Probability, Random Variables and Stochastic Processes. (Electrical & Electronic Bacheloring Series). McGraw-Hill International, 3rd edition, 1991.

17. Complementary bibliography:

1- Charles W. Therrien and Murali Tummala. Probability and Random Processes for Electrical and Computer Bachelors, CRC Press, 2nd edition, 2011.

2- Charles W. Therrien. Discrete Random Signals and Statistical Signal Processing. (Prentice-Hall Signal Processing Series). Prentice-Hall International, 1992.

3- Hwei P. Hsu. Probability, Random Variables, and Random Processes. Schaum's Outline. McGraw-Hill.

4- T. T. Soong. Fundamentals of Probability and Statistics for Bachelors. John Wiley & Sons, 2004.

5- Scott Miller and Donald Childers, Probability and Random Processes, 2nd edition, Academic Press, 2012.

6- José Paulo A. Albuquerque, José Mauro Pedro Fortes and Weiler A. Finamore, Probabilidade e Variáveis Aleatórias e Processos Estocásticos, Editora PUC-Rio, 2008.