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:
Numerical Computation

5. Code of the curricular component (filled by PROGRAD)**:**
TI0117

6. Prerequisites	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		CB0664	Fundamentals of Calculus
		CB0699	Applied Algebra I
		TI0109 or CK0108	Introduction to Computer Programming or Fundamentals of Computer Programming

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

8. Equivalences	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		CB0696	Introduction to Algebra
		CK0182	Numerical Methods

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.**

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

10. Regime of the curricular component:
(x) Semester ( ) Yearly ( ) Modular

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

Due to the increasing complexity and/or dimension of engineering and scientific problems, the analythical solution of these problems often becomes impractical. In order to solve such problems, many methods were developed to numerically obtain solutions using digital computers. As a consequency, computers became fundamental tools to work in the engineering and science areas, where specialized software packets offer programs to solve a wide gamma of problems. Thus, , knowing the main numerical methods for engineering and sciences became fundamental to guide their correct usage, as well as to understand their main advantages, disadvantages and limitations.

12. Objectives fo the curricular component:

This course has as objective introduce the student to computationanl methods applied to the numerical solution of engineering problems, especially in the context of telecommunications engineering.

13. Syllabus:

Errors in numerical approximation. Roots of functions. Numerical solution of systems of nonlinear and linear equations. Interpolation and regression. Numerical differentiation and integration. Solution of ordinary differential equations. Applications to telecommunication engineering problems.

14. Program:

1. **Errors in numeric approximation**: Fundamentals; Number representation in digital computers; Erros in numerical solutions: rounding, trunctation, and total errors.
2. **Roots of functions**: Fundamentals; Bisection method; Regula Falsi method; Newton's method; Secant method; Fixed-point method.
3. **Numerical solution of systems of nonlinear equations**: Fundamentals; Newton's and Newton-Raphson's methods; Fixed-point method.
4. **Numerical solution of systems of nonlinear equations**: Fundamentals; Gauss elimination method; Gauss-Jordan elimination method; LU decomposition; Jacobi's iterative method; Gauss-Seidel's iterative method.
5. **Regression**: Fundamentals; Linear regression; Polynomial regression.
6. **Interpolation**: Fundamentals; Lagrange's interpolation; Newton's inteporlation.
7. **Numerical differentiation**: Fundamentals; Finite differences approximation; Differentiation using Lagrange's interpolation polynomials.
8. **Numerical integration**: Fundamentals; Rectangle method; Trapezoidal method; Simpson's methods.
9. **Solution of ordinary differential equations**: Fundamentals; Euler's method; Modified de

Euler's method; Central-point method; Runge-Kutta's methods; Systems of ordinary differetial equations; Solution of higher order differential equations.

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- Amos Gilat and Vish Subramaniam, Métodos Numéricos para Engenheiros e Cientistas: Uma Introduction com Aplicações Usando o Matlab, 1st edition, Artmed/Bookman, 2008.

2- Steven C. Chapra and Raymond P. Canale, Métodos Numéricos para Engenharia, 5th edition, Artmed/McGraw-Hill, 2008.

3- Neide M. B. Franco , Cálculo Numérico, 1st edition, Pearson, 2006

17. Complementary bibliography:

1- Richard L. Burden and J. Douglas Faires, Análise Numérica, 8th edition, Cengage-Learning, 2008

2- Anne Greenbaum and Timothy P. Chartier, Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms, Princeton University Press, 2012.

3- John H. Mathews, Kurtis K. Fink, Numerical Methods Using Matlab, 4th edition, Pearson, 2004.

4- J. Douglas Faires, Richard L. Burden, Numerical Methods, 3rd edition, Cengage Learning, 2002.

5- Won Y. Yang, Wenwu Cao, Tae-Sang Chung, John Morris, Applied Numerical Methods Using Matlab, 1st edition, Wiley-Interscience, 2005.