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 Sciences

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

Mathematics 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:
Complex Variables

5. Code of the curricular component (filled by PROGRAD)**:**
CB0682

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

7. Co-requisite	No (x)	Yes ( )	
		Code	Name of the curricular component / activity

8. Equivalences	No ( )	Yes (x)	
		Code	Name of the curricular component / activity
		TI0049	Applied Mathematics for Engineering

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

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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.**

(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

As a natural extension of the Calculus for Real Functions, the Calculus for Complex Functions is of fundamental importance in solving problems in Mathematics and in applications to other Sciences. Hence, the relevance of the study of this discipline by the students of the courses of Mathematics, Physics and Engineering.

12. Objectives for the curricular component:

To introduce functions of a complex variable, extending the calculus of real single-variable functions, aiming to familiarize the student with the Cauchy formula and its consequences, with the integration techniques, with the development in series and the calculation of residues, and with the applications of calculus to the calculation of improper integrals.

13. Syllabus:

Complex numbers. Complex functions of a complex variable. Derivation. Integration. Residue theorem. Applications.

14. Program:

1. Complex numbers: the body of complex numbers; polar representation; n-th roots of the unit; topology of the complex plane.
2. Analytical functions: limits and continuity; complex derivation; Cauchy-Riemann equations; algebraic functions; harmonic functions.
3. Elementary functions: exponential; branches of logarithms; branches of power; trigonometric and hyperbolic functions; transformations of regions by elementary functions.
4. Integrals: paths and contours; integral of a complex function and its properties; cauchy-goursat theorem; cauchy integral theorem; liouville's theorem; Morera's theorem; fundamental theorem of algebra; principle of the maximum; index of a point with respect to a curve.
5. Power series: Taylor series; properties; radius of convergence; Laurent series; integration and differentiation of power series; unity of the power series.
6. Singularity and residues: zeros and poles of an analytical function; Residue theorem; applications to the calculation of improper integrals.
7. Conforming applications: definition and examples; conjugated harmonic functions; applications.

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- M. G. Soares. Cálculo em uma Variável Complexa. IMPA, Rio de Janeiro, 2007;

2- C. S. Fernandez e N. C. Bernardes Jr. Introdução às Funções de uma Variável Complexa. SBM, Rio de Janeiro, 2008;

3- R. V. Churchill. Variáveis Complexas e suas Aplicações. McGraw-Hill do Brasil e Editora da Universidade de São Paulo, São Paulo, 1975.

17. Complementary bibliography:

1- Brown, J.W., Churchill, R.V. Complex Variables and Applications,8th Edition, McGrawHill, 2009;

2- A. Lins Neto. Funções de uma Variável Complexa. IMPA, Rio de Janeiro, 1996;

3- D. McMahon, A. Costa e G. Meira. Variáveis Complexas Desmistificadas. Ciência Moderna, Rio de Janeiro, 2009.