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 | 03 | - |

**4. Name of the curricular component:**
Differential and Integral Calculus III

**5. Code of the curricular component** (filled by PROGRAD)**:**
CB0536

| | | | |
|---|---|---|---|
| **6. Prerequisites** | No ( ) | Yes (x) | |
| | | Code | Name of the curricular component / activity |
| | | CB0664 | Fundamentals of Calculus |
| | | | |
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|---|---|---|---|
| **7. Co-requisite** | No (x) | Yes ( ) | |
| | | Code | Name of the curricular component / activity |
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|---|---|---|---|
| **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)**:**
(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 understanding by the students of the extension of differential and integral calculus to functions of several variables and their application is essential for most modern developments in Mathematics and Physics.

**12. Objectives for the curricular component:**

After this course, the student must have understood the extension of the differential calculus and integral to functions of several variables and their application.

**13. Syllabus:**

Curves and vectors in space. Surfaces, planes, and quadric surfaces. Functions of several variables. Limit, continuity and differential calculus of real-valued functions of several real variables. Maxima, minima, and saddle points. Conditional maxima and minima: Lagrange multipliers. Theorems of implicit and inverse functions. Double and triple integrals. Theorem of change of variables. Improper multiple integrals. Scalar and vector line integrals. Green's theorem. Parametrization and surface area. Scalar and vector surface integrals. Theorems of Gauss and Stokes. Physical interpretations: conservative fields.

**14. Program:**

1. Analytical geometry in space; curves and vectors in the plane and in space; definition of vector functions: geometric interpretation of its image; parametrization of lines, circumferences, ellipses, hyperbolas, parabolas, cycloids, graphs of real-valued functions, helices; derivatives from vector functions: geometric interpretation;
2. Curves and surfaces in $R^3$: planes; cylinders; surfaces of revolution; quadric surfaces; parametrization of curves obtained as intersections of two surfaces;
3. Functions of $R^2$ and $R^3$ into R: definition and domain; graph of two-variable functions; curves and level surfaces; limit, continuity and partial derivatives; differentiability conditions; tangent plane and normal to surfaces that are graphs of functions of $R^2$; chain rule; gradient, normal vector and tangent plane to level surfaces, tangent vector to curves obtained as intersection of two level surfaces; directional derivatives, higher order partial derivatives;
4. Curves and vectors in the plane; curves and surfaces in $R^3$ and functions of $R^2$ and $R^3$ into R – exercises;
5. Maxima and minima of functions of $R^2$ and $R^3$ into R: critical points and relative maximum and minimum points; second derivative test, for functions of $R^2$ into R; absolute maxima and minima; conditional maxima and minima: method of Lagrange multipliers;
6. Maxima and minima of functions of $R^2$ and $R^3$ into R – exercises;
7. The implicit function theorem and the inverse function theorem;
8. Multiple integrals: definition of double integral; double integral and iterated integral for a limited and closed domain; double integral applications; Jacobian and change of variables in double integrals; definition of triple integrals; triple integrals and iterated integrals; triple integral applications; change of variables in the triple integrals (cylindrical coordinates and spherical coordinates); multiple improper integrals;
9. Line integrals: definition of scalar field line integral; definition of vector field line integral; conservative fields and path independence; Green's theorem; characterization of the conservative fields in the plane;
10. Surface integrals: parametrization of surfaces; surface area; definition of scalar field surface integral; definition of vector field surface integral; applications;
11. Multiple line and surface integrals – exercises;

12. Gauss's theorem: the divergent and Gauss's theorem; applications;
13. Stokes' theorem: the rotational and Stokes' theorem; characterization of conservative fields in space;
14. Applications of Gauss's and Stokes' theorems.

**15. Workload description**

| Number of Weeks: | Number of Credits: | Total Workload in Hours: | Theory Workload in Hours: | Practice Workload in Hours: |
|---|---|---|---|---|
| 16 | 06 | 96 | 96 | - |

**16. Basic bibliography:**


1- J. Stewart. Cálculo, Volume 2. Cengage Learning, 2010. Sexta edição;

2- J. Marsden e A. Tromba. Vector Calculus, 5a Edição. W. H. Freeman, Nova Iorque, 2003;

3- G. Simons. Cálculo com Geometria Analítica, Volume 2. McGraw-Hill, 1987.


**17. Complementary bibliography:**


1- T. Apostol. Calculus II. Blaisdell, Nova Iorque, 1962;

2- G. B. Thomas. Cálculo, Volumes 2 e 3. Addison Wesley, São Paulo, 2003;

3- L. Leithold. O Cálculo com Geometria Analítica, Volume 2. Harbra, São Paulo, 1987;

4- H. L. Guidorizzi. Um Curso de Cálculo, Volume 3. LTC, Rio de Janeiro, 2001;

5- H. Anton. Cálculo: um Novo Horizonte, Volume 2. Bookman, São Paulo, 2000;

6- W. Kaplan. Cálculo Avançado, Volume 1. Edgard Blücher, São Paulo, 2002;

7- A. Rex e M. Jackson. Integrated Calculus and Physics, Volume II. Addison-Wesley, Nova Iorque, 2000.