



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:

Antennas

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

TI0065

6. Prerequisites	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		TI0053	Waveguides

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

8. Equivalences	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		TI0032	Antennas

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

Morning Afternoon Night

¹ Fill with *Bachelor (Engineer), Licenciante, 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: Semester Yearly Modular**11. Justificatory for the creation/regulamentation of this curricular component**

Provide the conceptual basis and the tools for analysis and design of antennas.

12. Objectives for the curricular component:

To enable students to analyze and design radio communication systems.

13. Syllabus:

Types of Antennas. Radiation Mechanism and Applications. Maxwell's Equations and Radiation Integrals. Basic Parameters of Antennas. Linear Antenna Theory. Applications of Linear Antennas. Moment Method for Linear Antennas. Antenna Array Theory and Applications. Theory of Aperture Antennas. Reflecting Antennas, Horns and Antennas Lenses. Synthesis of Antennas.

14. Program:

- 1. Types of Antennas, Radiation Mechanism and Applications:** Introduction; antenna types; radiation mechanism; historical development; areas of application.
- 2. Maxwell's Equations and Radiation Integrals:** Maxwell's equations; electric and magnetic vector potential; Green function for the free space; radiation integrals; infinitesimal electric dipole.
- 3. Basic Antenna Parameters:** Radiation diagram and field regions; radiated power density and radiation intensity; directivity and beam efficiency; gain and efficiency of the antenna; antenna polarization and polarization loss factor; input impedance and antenna bandwidth; antenna radiation efficiency; antenna as an aperture; directivity and maximum effective aperture; Friis transmission equation; reciprocity for the radiation diagram.
- 4. Linear Antenna Theory:** Short dipole and half-wavelength dipole; linear elements on an infinite ground plane; effect of the earth on the antenna properties; square and circular loop antenna; applications of linear antennas; applications to VLF and LF bands; broadcasting antennas; applications to the HF and VHF bands; wideband antennas.
- 5. Moment Method for Linear Antennas:** Integral equation for linear antenna; Solution of the integral equation using the moment method; antenna source modeling.
- 6. Antenna Arrays and Applications:** two element array; uniform linear arrays; two-dimensional uniform arrays; synthesis of antenna array diagram; Yagi-Uda antenna.
- 7. Aperture Antenna Theory:** Principle of equivalence; radiation equations; rectangular aperture; circular aperture; microstrip antennas; geometric theory of diffraction.
- 8. Reflecting Antennas, Horn Antennas and Antennas Lenses:** Parabolic reflector: focal point and offset system; Cassegrain and Gregorian systems; pyramidal and conical horn antenna; corrugated horn antenna, antennas lenses.

15. Workload description

Number of Weeks:	Number of Credits:	Total Workload in Hours:	Theory Workload in Hours:	Practice Workload in Hours:
16	06	96	64	32

16. Basic bibliography:

- 1- Constantine, A. Balanis; "Antenna Theory - Analysis and Design", John Wiley & Sons. 1997.
- 2- Kildal, Per-Simon; "Foundations of Antennas"; Studentlitteratur. 2000.
- 3- Stutzman, Warren L. and Thiele, Gary A.; "Antenna Theory and Design", 2nd edition, John Wiley & Sons, 1997.

17. Complementary bibliography:

- 1- Fujimoto, K. and James, J. R.; "Mobile Antenna Systems Handbook"; Second Edition; Artech House Publishers. 2001.
- 2- Kumar, A.; "Antenna Design with Fiber Optics"; Artech House Publishers. 1996.
- 3- Esteves, Luiz Claudio; "Antenas - Teoria Básica and Aplicações", McGraw-Hill.