



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	Optional	-	-

4. Name of the curricular component:

Mobile Communications I

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

TI0063

6. Prerequisites	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		TI0120	Communication Principles

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

8. Equivalences	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		TI0020	Mobile Communication Systems I

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**

Mobile communications systems, such as mobile telephony ones, represent an important means of communication, with great economic and social impact, making it necessary to understand the technical details of its operation.

12. Objectives fo the curricular component:

The objective of this course is to introduce the main physical and logical components of mobile communications systems, especially mobile telephony; explain the foundations of the physical phenomenology involved in the transmission of radio signals; present strategies for the planning, monitoring and optimization of mobile communications networks, enabling students to design and operate these same networks.

13. Syllabus:

Introduction to Wireless Communications and Mobile Telephony Systems. Antennas and Radio Wave Propagation Mechanisms. Path Loss Calculation Methods. Coverage Prediction. Interference in Mobile Communications. Capacity Analysis in Mobile Telephony. Methodologies for Mobile Telephony Network Planning. Control Signals and Mobile Telephony Network Management.

14. Program:

- 1. Introduction to Mobile Telephony Systems and Wireless Communications:** History. Key components of a mobile phone system. Frequency reuse patterns. Fundamentals of deterministic multiple access techniques. Fundamentals of random access techniques. Main cellular telephony systems in operation. Main types of control signals in cellular telephony. Types of handoff. Handoff implementation methods. Mobility management in wireless networks. Interface with Public Switched Telephone Network. Interoperability standards between wireless networks.
- 2. Antennas and Radio Wave Propagation Mechanisms:** Definition. Characteristics. Practical antennas for mobile communications. Propagation in free space. Propagation by reflection. Propagation by diffraction. Other effects. Descriptive mechanisms of the propagated signal.
- 3. Path Loss Calculation Methods:** Empirical models. Semi-empirical models. Deterministic models. Methods for indoor environments. Modeling for large-scale simulation of path loss in mobile communications systems.
- 4. Coverage Prediction:** Characterization of small scale fading. Characterization of the large scale fading. Prediction of cell coverage. Macroscopic and microscopic spatial diversity. Large scale modeling and simulation of fading. Thermal noise. Link analysis. Margin against shadowing. Maximum range. Link budget. Link balancing.
- 5. Interference in Mobile Communications:** basic notions of intersymbol interference and Doppler effect; co-channel interference analysis: signal-to-interference ratio, influence of frequency reuse standardization, influence of antenna pattern, influence of propagation environment. Outage probability: environment with log-normal fading, environment with

Rayleigh fading. Modeling for large-scale simulation of co-channel interference.

6. **Capacity Analysis in Mobile Telephony:** Instantaneous capacity. Traffic theory. Traffic capacity. Capacity analysis in mobile communications systems. Impact of antenna sectorization. Impact of reuse pattern. Strategies for capacity enhancement.
7. **Mobile Network Planning:** Network topologies in mobile telephony. Access network planning. Coverage-oriented planning. Capacity-oriented planning. Satisfaction of quality of service. Tolerance to interference. Network core planning. Practical case study.
8. **Radio Resources Management:** optimization dimensions in mobile communications systems; quality of service and quality of experience; capacity versus fairness tradeoff; power control; dynamic channel allocation; packet scheduling; admission control; congestion control.

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- Antennas and Propagation for Wireless Communication Systems: 2nd Edition (Hardcover), Simon R. Saunders (Author), Alejandro Aragon-Zavala, Wiley, 2007, ISBN-10: 0470848790; ISBN-13: 978-0470848791
- 2- Lecture notes

17. Complementary bibliography:

- Principles of Wireless Networks: A Unified Approach; by Kaveh Pahlavan (Author), Prashant Krishnamurthy; Prentice-Hall, 2001, ISBN-10: 0130930032, ISBN-13: 978-0130930033
- Wireless Communications: Principles and Practice (2nd Edition), Theodore S. Rappaport, Prentice-Hall, 2002, ISBN-10: 0130422320, ISBN-13: 978-0130422323
- Principles of Mobile Communication (2nd Edition) (Hardcover), Gordon L. Stüber; Springer, 2000, ISBN-10: 0792379985, ISBN-13: 978-0792379980
- CDMA Systems Bacheloring Handbook; Lee, Jhong Sam And Miller, Leonard E.; Artech House, 1997.