



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:

Electronic and Optoelectronic Materials

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

TI0060

6. Prerequisites	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		CB0801	Introduction to the Ordinary Differential Equations
		CD0241	Principles of Modern Physics
		TI0115	Applied Electronmagnetism

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

8. Equivalences	No ()	Yes (x)	
		Code	Name of the curricular component / activity
		TI0011	Introduction to the Engineering of Opto-Electronic Materials

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

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.

(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

In this course we intend to study the material structure necessary for a perfect understanding of conductive, semiconducting and insulating devices as well as magnetic materials used in electronic devices.

12. Objectives fo the curricular component:

1. Provide the student with conceptualization, understanding of the relationships that exist between the structure and properties of materials.
2. Provide the student with the understanding of the properties of matter that explain the operation of various electronic devices.

13. Syllabus:

Introduction to Quantum Mechanics; Electrons in crystals; Semiconductor materials; Semiconductor Diodes; Transistors; Opto-Electronic Materials; Magnetic Materials and Devices; Superconductors.

14. Program:

1. **Introduction to Quantum Mechanics:** Heisenberg's uncertainty principle, postulates of quantum mechanics, solutions of Schrödinger's equation for wells, wires and quantum dots.
2. **Electrons in crystals:** energy bands, conductors, insulators and semiconductors, the Fermi-Dirac distribution, electrical current in metals.
3. **Semiconductor materials:** intrinsic and extrinsic semiconductors, dynamics of electrons and holes in semiconductors.
4. **Semiconductor diodes:** PN junction, polarized junction current, junction diode, heterojunctions, Schottky diode, Zener diode.
5. **Transistors:** Bipolar transistor: physical model, Ebers-Moll model and dynamic model, Field Effect Transistor: JFET and MOSFET.
6. **Opto-Electronic Materials:** Optical properties of materials, interaction of radiation with matter, spontaneous emission, stimulated emission, rate equations, laser diode.
7. **Magnetic Materials and Devices:** magnetism and magnetic materials: diamagnetic, paramagnetic and ferromagnetic, ferrite and their applications in microwave, magneto-resistance and spintronics.
8. **Superconductors:** Theory of superconductivity, superconducting materials, superconducting coils, Josephson junctions.

15. Workload description

Number of Weeks:	Number of Credits:	Total Workload in Hours:	Theory Workload in	Practice Workload in Hours:
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16	04	64	Hours: 64	-
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16. Basic bibliography:

- 1- Electrooptics, Phenomena, Materials, Applications, F.A. Lopez, J.M. Cabrera, F. A. Rueda Academic Press, 1994.
- 2- Materials Science and Bacheloring an Introduction, W.D. Callister,Jr, John Wiley and Sons, 1997.
- 3- Materiais e Dispositivos Eletrônicos, S. M. Rezende, Livraria da Física, 2ª Ed., 2004.

17. Complementary bibliography:

- 1- Quantum Electronics, A. Yariv, John Wiley and Sons, 1989.
- 2- Introduction to Superconductivity and High-Tc Materials, M. Cyrot, D. Pavuna, World Scientific, 1995.
- 3- Aplicações da Supercondutividade, A. M. Luiz, Edgard Blücher, 1992.