

## 230082 - FDE - Fundamentals of Electronics

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|---------------------|---|
| Coordinating unit:  | 230 - ETSETB - Barcelona School of Telecommunications Engineering   |
| Teaching unit:      | 710 - EEL - Department of Electronic Engineering  |
| Academic year:      | 2019  |
| Degree:             | BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Compulsory) |
| ECTS credits:       | 7   |
| Teaching languages: | Catalan, Spanish  |

### Teaching staff

|              |  |
|--------------|--|
| Coordinator: | Voz Sanchez, Cristobal   |
| Others:      | Altet Sanahujes, Josep<br>Bermejo Broto, Alexandra<br>Fernandez Chimeno, Mireya<br>Lopez Gonzalez, Juan Miguel<br>Martin Garcia, Isidro<br>Molinas Mata, Pau<br>Orpella Garcia, Alberto<br>Ortega Villasclaras, Pablo Rafael<br>Puigdollers Gonzalez, Joaquin<br>Rodriguez Martinez, Angel<br>Rubio Sola, Jose Antonio<br>Tous Muntaner, Ignacio<br>Vargas Drechsler, Manuel Agustin |

### Degree competences to which the subject contributes

#### Generical:

10 ECI N1. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.

### Teaching methodology

Theoretical classes  
Laboratory classes  
Cooperative work (out of classrooms)  
Individual work (out of classrooms)  
Short answer controls (Test)  
Long answer controls  
Long answer controls (Final examination)  
Laboratory  
Laboratory examination

### Learning objectives of the subject



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### Study load

|                           |                    |     |        |
|---------------------------|--------------------|-----|--------|
| Total learning time: 175h | Hours large group: | 52h | 29.71% |
|                           | Hours small group: | 26h | 14.86% |
|                           | Self study:        | 97h | 55.43% |

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### Content

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| <p>Analysis of electric circuits</p>   | <p>Learning time: 50h<br/>Theory classes: 20h<br/>Self study : 30h</p> |
| <p>Description:<br/>Electric charge, current and potential. Components and electrical circuits. Conductive elements and switches. Voltage and current independent sources. Resistance and Ohm's law. Equivalent resistance. Linear controlled sources. Electrical Power. Kirchhoff's law. Analysis of electrical circuits by the junction and loop rules. Linear circuit. Superposition. Thevenin and Norton equivalent circuits. Signal and power electrical transfer.</p>  |  |
| <p>The capacitor and the inductor</p>  | <p>Learning time: 12h<br/>Theory classes: 5h<br/>Self study : 7h</p>   |
| <p>Description:<br/>The capacitor as electrical element. Capacity. Equivalent capacitor. The inductor as electrical element. Induction. Equivalent inductor. Transient analysis of first order electrical circuits with capacitors and inductors. Electrical energy in capacitors and inductors.</p>   |  |
| <p>The junction diode and its applications</p>   | <p>Learning time: 25h<br/>Theory classes: 10h<br/>Self study : 15h</p> |
| <p>Description:<br/>Introduction to semiconductor physics. Concept of semiconductors. The silicon case. Intrinsic and doped semiconductor. Charge carriers: the electron and the hole. Energy bands. Drift and diffusion currents. The PN junction diode. Rectifying effect. Breakdown of the diode.<br/>The diode as an element of electronic circuits. Approximated models for the diode. Ideal and piecewise linear models. Analysis of circuits with diodes using simplified models. Applications of the diode. Rectifying, limiting and stabilizing circuits.</p> |  |
| <p>The transistor and the signal amplifier</p>   | <p>Learning time: 25h<br/>Theory classes: 10h<br/>Self study : 15h</p> |
| <p>Description:<br/>The bipolar junction transistor. Input and output characteristics. Regions of operation and basic equations. The field-effect transistor. Input and output characteristics. Regions of operation and basic equations. Amplifying circuits based on transistors. Power supply, signal and load in electronic circuits. Biasing of the transistor. Bias point. Small signal equivalent circuit. Voltage gain, input and output resistances. Load line and dynamic range.</p>   |  |

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| Laboratory of Electronic   | Learning time: 60h<br>Laboratory classes: 26h<br>Self study : 34h |
| Description:<br><ol style="list-style-type: none"><li>1. Presentation of the Laboratory</li><li>2. The power source and the digital multimeter</li><li>3. Electric measurements in DC</li><li>4. The oscilloscope and function generator</li><li>5. Introduction to the operational amplifier</li><li>6. Introduction to RC circuits</li><li>7. Control of electronic instrumentation</li><li>8. Fabrication of a wave square generator</li><li>9. Electric characteristic of a diode, LED and Zener</li><li>10. The transformer, rectifying circuits and capacitor filter.</li><li>11. The bipolar junction transistor: DC analysis</li><li>12. Signal amplification with a bipolar junction transistor</li></ol> |   |

### Qualification system

Laboratory: 20% (20% practice, 40% instrumentation exam, 40% laboratory exam)

Midterms: 40%

Final exam: 40%

### Bibliography

#### Basic:

Prat Viñas, Lluís; Bragós Bardia, Ramon. *Circuits i dispositius electrònics : fonaments d'electrònica* [on line]. 2a ed. Barcelona: Edicions UPC, 2002 [Consultation: 13/07/2015]. Available on: <<http://hdl.handle.net/2099.3/36163>>. ISBN 8483015749.

Thomas, R. E; Rosa, A. J. *Circuitos y señales : introducción a los circuitos lineales y de acoplamiento*. Barcelona [etc.]: Reverté, 1991. ISBN 8429134581.

#### Complementary:

Floyd, T. L. *Electronics fundamentals : circuits, devices, and applications*. 8th ed. Upper Saddle River, NJ [etc.]: Prentice Hall, 2010. ISBN 9780135096833.

Senturia, S. D; Wedlock, Bruce D. *Electronic circuits and applications*. New York: John Wiley and Sons, 1975. ISBN 0471776319.

Malik, N. R. *Circuitos electrónicos : análisis, diseño y simulación*. Madrid [etc.]: Prentice Hall, 1996. ISBN 8489660034.