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| ELECTRONICS ENGINEERING FUNDAMENTALS                          |  |                       |
| BACHELOR IN INDUSTRIAL ELECTRONICS AND AUTOMATION ENGINEERING | ACADEMIC YEAR: 2 <sup>nd</sup> (2020-2021) | TERM: 2 <sup>nd</sup> |

*The course has 29 sessions distributed during 15 weeks. The duration of each session is 100 minutes (50 + 50) with (10+10) minutes break between each session. The laboratory sessions are set in six of these sessions, specifically those addressed as SEMINARS.*

| PLANIFICACIÓN SEMANAL DE LA ASIGNATURA |         |  |         |         |   |   |   |             |                                   |
|--|---------|--|---------|---------|---|---|---|-------------|-----------------------------------|
| WEEK                                   | SESSION | DESCRIPTION OF THE SESSION CONTENTS  | GROUP   |         | Indicate if it is a different location from the classroom | Indicate YES/NO if it is a session with >1 teaching staff | STUDENT WEEKLY HOMEWORK LOAD  |             |                                   |
|  |         |  | LECTURE | SEMINAR |   |   | DESCRIPTION   | CLASS HOURS | HOMEWORK HOURS (Max. 7h per week) |
| 1                                      | 0       | Preliminar session.<br><b>Review.</b> Electronic signals. Classification. Characteristics. Review of electric circuit analysis and basic circuit theory. |         | X       |   |   | A review of the basic concepts of electrical engineering to be applied this course:<br>Types of electronic signals.<br>Parameters and characteristics.<br><br>Course guidelines | 1,66        |                                   |

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|---|---|--|---|---|--------|----|---|------|------|
| 1 | 1 | <p><b>Introduction to the course and lab sessions. Guidelines.</b></p> <p><b>Topic 1. Electronic systems: and introduction.</b><br/>Basic concepts on amplifiers, transducers, power sources.<br/>Electronic Systems: some examples.</p> | X |   | ONLINE |    | <p>Examples of real systems and applications based on electronic systems.<br/>Top-down analysis of an electronic desing. Block diagram of a generic electronic system.</p> <p>SPOC lab enabling course.</p>   | 1,66 | 2,86 |
| 2 | 2 | <p><b>Topic 2. Electronic instrumentation. Sensors and transducers</b><br/>Sensors and transducers. Principle of operation.<br/><br/>Linearity and superposition</p>   |   | X |        |    | <p>Overview of different electronic sensors and transducers for sensing input physical magnitudes: light, temperature, force y pressure, position, speed y sound</p>  | 1,66 | 6    |
| 2 | 3 | <p>Exercises including sensors and transducers within an electronic circuit.</p> <p><b>Topic 3. Amplifiers and analog electronic subsystems</b><br/>Classification and modeling. Operation. Gain, linearity, frequency response</p>      | X |   | ONLINE |    | <p>Linearity and superposition in electronic systems.<br/>Examples of real systems and applications based on electronic systems.</p> <p>Top-down analysis of an electronic desing. Block diagram of a generic electronic system.<br/>Amplification in electronic systems.<br/>Amplifying the output signal provided by a sensor/transducer</p> <p>SPOC lab enabling course.</p> | 1,66 |      |
| 3 | 4 | <p><b>Electronic instrumentation.</b><br/>Electronic instrumentation and measurement of electronic signals.</p>  |   | X | LAB    | NO | <p>Implementation of basic electronic circuits and electronic equipment handling.</p>   | 1,66 | 7    |

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| 3 | 5  | <b>Topic 3. Amplifiers and analog electronic subsystems</b><br>Description, modeling and operation.<br>Negative feedback topologies and applications.<br>Basic exercises with electronic amplifiers. | X |   | ONLINE |     | Operational amplifiers and negative feedback topologies.<br>Op-amp based amplifying stages in different real applications.<br>Basic electronic amplifier exercises<br><br><b>SPOC lab enabling course.</b><br><br><b>Preparation of Practice 1</b>          | 1,66 |   |
| 4 | 6  | Amplifier based exercises<br>Practice 1 discussion   |   | X |        | NO  | Study through simulations of amplifier models that include load effects in real circuits.<br><br>Exercises involving operational amplifiers<br>Practice 1 discussion<br><b>Preparation of Practice 1</b><br><br><b>Obtain the lab-enabling certificate.</b> | 1,66 | 7 |
| 4 | 7  | <b>Software for analog circuit simulation</b><br>First steps with the simulation software.<br>Simulation of amplifying stages.   | X |   | ONLINE |     |   | 1,66 |   |
| 5 | 8  | <b>PRACTICE 1: Electronic sensors and transducers</b>  |   | X | LAB    | YES | Implementation of basic electronic schemes involving some of the sensors studied.   | 1,66 | 6 |
| 5 | 9  | <b>Topic 4. Electronic components.</b><br>MOSFET transistor.<br>Operation. Applications in both digital and analog electronic systems.   | X |   | ONLINE |     | Study of MOSFET transistors and their use in both analog (amplifiers) and digital (inverter logic gate) circuits  | 1,66 |   |
| 6 | 10 | Amplifier based exercises<br>Practice 2 discussion   |   | X |        |     | Exercises involving amplifiers  | 1,66 | 6 |
| 6 | 11 | <b>Topic 4. Electronic components</b><br>Diode.<br>Operation. Applications in electronic systems. Clipping circuits and Zener diode  | X |   | ONLINE |     | Study of diode's principle of operation and their use cases.<br><br><b>Preparation of Practice 2</b>  | 1,66 |   |

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| 7  | 12 | <b>PRACTICE 2: Amplifying stages with Operational Amplifiers</b>   |   | X | SIMUL  | YES | <b>Resolution of practice 2 (simulation)</b>   | 1,66 | 7 |
| 7  | 13 | Diode-based real electronic applications. Rectifiers and application to energy conversion electronic systems. Energy and efficiency concepts   | X |   | ONLINE |     | Exercises of diode-based electronic circuits and MOSFET-based electronic sources for powering sources.   | 1,66 |   |
| 8  | 14 | Exercises about diodes as rectifiers   |   | X |        |     | Study of MOSFET transistors exercises and their use in real circuits.<br>Study of the need for digital electronic circuits.  | 1,66 | 6 |
| 8  | 15 | <b>Topic 5. Digitals electronic subsystems</b><br>Fundamentals of digital electronics. Numbering and coding in digital systems. Boolean algebra. Basic logic gates. Boolean logic functions and representation | X |   | ONLINE |     | Fundamentals of digital electronics and coding systems in the digital domain. Boolean algebra and logical functions and the way to represent them. Study of the basic logic gates. | 1,66 |   |
| 9  | 16 | Resolution of problems (MOSFET and diodes) and review the concepts   |   | X |        |     | Complete and review main questions about analogue electronics.   | 1,66 |   |
| 9  | 17 | Combinational circuits in digital electronics.<br>Sequential circuits in digital electronics.<br>Basic examples  | X |   | ONLINE |     | Study of basic combinational circuits and their main applications.<br>Study of basic sequential circuits and their main applications.<br><b>Preparation of Practice 3</b>          | 1,66 | 6 |
| 10 | 18 | <b>PRACTICE 3: CIRCUITS WITH TRANSISTORS</b>   |   | X | SIMUL  |     | <b>Resolution of practice 3 (simulation)</b><br>Basic use cases of digital electronic units.   | 1,66 | 6 |

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| 10 | 19 | Applications of digital circuits (I)<br>Implementation of logic function with multiplexers and decoders.   | X |   | ONLINE |     | Preparation for MIDTERM Exam   | 1,66 |   |
| 11 | 20 | <b><u>MIDTERM EXAM</u></b>   |   | X |        |     | Preparation for MIDTERM Exam   | 1,66 | 6 |
| 11 | 21 | Applications of digital circuits (II)<br>Memories  | X |   | ONLINE |     | Lab session involving operational amplifiers.  | 1,66 |   |
| 12 | 22 | Applications of digital circuits (III).<br>Registers and digital counters.   |   | X |        | YES | Lab session working with MOSFET transistors  | 1,66 | 6 |
| 12 | 23 | <b>Interface between analog and digital electronic subsystems:</b> data conversion. Data conversion examples. A/D and D/A converters. Characteristics. | X |   | ONLINE |     | Study of the need for A/D and D/A circuits to convert signals from the analog to the digital domain and vice versa. D/A and A/D converters and their main characteristics.<br><br><b>Preparation of Practice 4</b> | 1,66 |   |
| 13 | 24 | <b><i>PRACTICE 4: DIGITAL SUBSYSTEMS (Simulation)</i></b>  |   | X | SIMUL  | YES | <b>Resolution of practice 4 (simulation)</b>   | 1,66 | 6 |
| 13 | 25 | A/D and D/A converter implementations.   | X |   | ONLINE |     | Implementations for real D/A and A/D converters  | 1,66 |   |
| 14 | 26 | Resolution of problems   |   | X |        |     | Knowledge of the process of integrated electronics manufacturing,  | 1,66 | 6 |

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| 14   | 27 | <b>Integrated circuits.</b><br>Manufacturing. Moore's Law.<br>Introduction to digital electronic<br>subsystems.<br><br>Problems and exercises upon demand.<br>Questions. | X |   | ONLINE | state-of-the art technologies and<br>future trends.<br><br>Preparation for the ordinary exam. | 1,66         |              |
| 15   | 28 | Problems and exercises. Questions.   |   | X |        | Preparation for the ordinary exam.  | 1,66         | 3            |
| <b>Subtotal 1</b>  |    |  |   |   |        |   | <b>48,14</b> | <b>86,86</b> |
| <b>Total 1 (Class and working hours between 1-14 weeks)</b>  |    |  |   |   |        |   | <b>135</b>   |              |
| 15   |    | Recovery lectures, mentorship,<br>deliverables, etc.   |   |   |        |   |              |              |
| 16   |    | Exam preparation UPON REQUEST and<br>Evaluation  |   |   |        |   |              |              |
| 17   |    |  |   |   |        |   | 3            | 12           |
| 18   |    |  |   |   |        |   |              |              |
| <b>Subtotal 2</b>  |    |  |   |   |        |   | <b>3</b>     | <b>12</b>    |
| <b>Total 2 (Class and working hours between 15-18 weeks)</b> |    |  |   |   |        |   | <b>15</b>    |              |
| <b>T TOTAL (Total 1 + Total 2. 180 hours max.)</b>           |    |  |   |   |        |   | <b>150</b>   |              |