Universidad Carlos III de Madrid
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	COURSE: ELECTRONICS ENGINEERING FUNDAMENTALS		
	DEGREE: BACHELOR IN ENERGY ENGINEERING	**YEAR: 2nd**	**TERM: 2nd**

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 five of these sessions.

COURSE WEEKLY PLAN

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		
			LECTURE	SEMINAR			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h per week)
1	2	**Introduction to the subject** - List of topics - Session organization - Practices: Calendar. Evaluation. - Calendar Modifications - Professors and groups. Classrooms - Tutorial schedule - Bibliography - Class attendance - Computer class session		X				1,66	2,86

2	1	**Introduction to the Electronic Systems** - The Outer world and the electronic world - Sensors (transducers) and actuators - Analog and digital systems - Block diagram. Full electronic system example **Digital electronics basic concepts** - Introduction. Basic concepts - Digital circuits and signals - Digital signal parameters - Basic logic functions	X				- Study of the basic concepts of Digital electronics, numerical systems and combinational circuits. - Proposed exercises solving		
2	2	**Combinational circuits and numerical systems** - Digital systems codification - Two's complement - Ex.1. Numerical systems - Boole algebra. Logic gates - Ex.2. Boole algebra minimization - Combinational circuit analysis - Ex.3. Combinational Adder - Homework		X				1,66	
3	1	**Decoders, multiplexers and synchronous systems** - Other combinational functions - Decoders - Multiplexer (MUX) - Synchronous sequential systems - D Flip-flop - Counters - Chronogram	X					1,66	
3	2	**Memories, programmable logic and logic functions synthesis.** **- Memories** - Basic parameters and terminology - Memory types - Addressing - Memory extension. Memory maps - Ex.5. Memory maps - Logic functions synthesis **- Programmable Logic**		X			- Decoders, multiplexers, synchronous systems and memories study	1,66	7

		- Programmable logic devices - Improvements and evolution - Logic functions synthesis with PLDs - Ex.6. Logic function synthesis - Homework							
4	1	**Digital System exercises. Integrated circuits technology** **- Digital System exercises** - Ex.9. Digital systems examples - Ex.10. Logic gates +MUX + Flip-flop - Ex.11. Decoders - Ex.12. Multiplexer + PLA - Homework **- Integrated circuits technology** - Computer Architectures. DSPs - Manufacturing. Videos	X				- Proposed exercises simulation	1,66	6
4	2	**Digital circuits software** - Software introduction - Ex.2. Boole algebra minimization from session 2 - Ex.7. Decoder - Ex.8 Flip-flop - Homework		X	COMP. CLASS		- **Practice 1&2** preparation and previous computations	1,66	
5	1	**Passive Components. Resistors** - Analog signals parameters - Ex.1. Mean and RMS values - Resistor and potentiometer characteristics - Circuits theory exercises - Ex.2. Thevenin, Norton. Potentiometer - Ex.3. Wheatstone Bridge - Ex.4. Superposition Theorem - Homework.	X				- Circuits theory - Proposed exercises resolution - Study for the partial evaluation - **Practice 1&2** preparation and previous computations		
5	2	***PRACTICE 1: COUNTER***		X	**LAB**	YES		1,66	6
6	1	**Passive Components. Capacitors** - Capacitors characteristics. - AC/DC capacitors behaviour.	X				- Filter theory study - Instrumentation study	1,66	

		- Capacitors: charge/discharge - Ej. 5. Charging a capacitor. **RC Filters. Temporal and frequency response.** - Low pass RC filter. Bode Diagram. - High pass RC filter. **Basic Instrumentation Basic Electronics. Measurement techniques** - Real powers of current and voltage. - Real Voltmeter/amperimeters. DC/AC modes. Load effects. - Oscilloscope. - Protoboard. - Ex. Instrumentation: load effects							
6	2	***PRACTICE 2: PERSONALIZED COUNTER***		X	**LAB**	YES		1,66	6
7	1	**EXAM PART 1: DIGITAL ELECTRONICS**	X				- Diodes and instrumentation study	1,66	6
7	2	**Components: Diode** - Semiconductors Introduction. - The PN junction diode. - Diode biasing. - Characteristic diode plot. - Diode types. Zener diode. - Datasheets. - Equivalent circuits. **Diode applications (I): Limiting circuits** - Ex.1, 2, 3: Limiting circuits. - Homework.		X				1,66	
8	1	**Diode applications (II):** Rectifiers - Power source. - Half wave rectifiers. - Half wave rectifier with capacitor. - Full wave rectifiers.	X				- Proposed exercises simulation - Diode applications study - **Practice 3** preparation and previous computations.	1,66	6
8	2	**Analog system simulation software** - Software Introduction - Ex.1. Voltmeter. Configuration and		X	COMP. CLASS			1,66	

		connection. - Ex.2. Oscilloscope. Configuration and connection. - Ex.3. Voltage Divider. Multimeter load effects. - Ex.4. RC serial circuit with square signal input. Capacitor Charge/discharge - Ex.5. RC serial circuit with sinewave signal input. - Ex.6. Half wave rectifier. - Homework: Simulations practice 3 and 4.							
9	1	**Diode exercises** -Ex.4. Full wave rectifier with capacitor. - Ex.5. Zener regulator. - Ex.6. Limiter circuit with diode and source. - Ex.7. Limiter with two diodes. - Homework.	X					1,66	7
9	2	***PRACTICE 3: RESISTIVE DIVIDER AND RC FILTER***		X	**LAB**	YES		1,66	
10	1	**Components: MOSFET transistor.** - Transistor types - Accumulation N cannel MOSFET - Structure and functionality - Static characteristic plot - Equation and working zones - Symbol and terminals - Biasing circuits - Other type of MOSFETs	X				- Proposed exercises resolution - MOSFETs study	1,66	
10	2	**MOSFET exercises** - Ex.1. Acumulation NMOS biasing circuit. - Ex.2. Autobiasing NMOS circuit. - Ex.3. MOSFET with RD variation to modify working region. ID-RD plots. - Ex.4. PMOS biasing circuit. - Ex.5. NMOS biasing circuit. - Homework		X			- Proposed exercises resolution	1,66	
11	1	**Components: BJT transistor** - BJT transistor: Symbols and terminals.	X				- BJTs study - Proposed exercises simulation	1,66	7

		Magnitudes. - Working regions and structure, Active mode. - Characteristic static plots. - Working regions and equations - Biasing circuits - Applications: Current source, switching mode. - Ex.1. NPN BJT Biasing circuit: Exact solving and approximating VTh by VB - Ex.2. PNP BJT biasing circuit - Homework						
11	2	**Exercises regarding transistors** - Ex.6. NMOS biasing with Rs. Amplification - Ex.7. BJT biasing. Digital switching. - Ex from past exams involving transistors - Ex.8. A.O. introduction. - Homework		X		- Proposed exercises regarding transistors		
12	1	**Analog subsystems: Amplification (I)** - Amplification concept - Amplifier types - Coupling capacitors - Bode amplifier diagram - The ideal operational amplifier - Ideal A. O. applications: - Open circuit: Comparator - Negative feedback: - Inverting - non inverting. - Adder – amplifier for D/A conversion	X			- Amplification study - Partial evaluation study	1,66	7
12	2	**Analog subsystems: Amplification (II)** - Ideal A. O. Applications with negative feedback: - Buffer - Differential amplifier - Instrumentation amplifier - A.O. integrator - A.O. derivator - Precision rectifier		X		- Amplification and current electronic system blocks study - Proposed exercises resolution.	1,66	6
13	1	**Amplification exercises**	X			- **Practice 4** preparation and	1,66	6

		- Ex.1. A.O. Inverting configuration - Ex.2. Adder – scaler for A/D conversion - Ex.3. Battery charger control system - Homework **Real electronic system block diagram** - Filters. sensors and actuators. - A/D conversion					previous computations. - Study for the **individual practice exam**		
13	2	***PRACTICE 4: ANALOG - DIGITAL CONVERSOR***		X	**LAB**	YES		1,66	
14	2	***PRACTICE 5: INDIVIDUAL EXAM***		X	**LAB**	YES		1,66	6
15	1	**Real electronic systems example** - D/A conversion - Electronic systems examples: - Ex.1. D/A converter resolution - Ex.2. D/A bit number - Ex.3. A/D converter resolution - Ex.4. A/D converter sampling frequency - Ex.5. A/D quantization.	X				- D/A and A/D converters - Proposed exercises resolution.	1,66	6
15	2	**- Electronic engineering fundamentals** **- Exercises resolution for the ordinary and extraordinary exams**		X			- Study for the **ordinary exam**	1,66	3

							Subtotal 1	**48,14**	**86,86**
							Total 1 *(Class and working hours between1-14 weeks)*	135	
15		Recovery, tutorial classes, etc Exam preparation UPON REQUEST							
							Subtotal 2	**3**	**12**
							Total 2 *(Class and working hours between15-18 weeks)*	15	
							TOTAL *(Total 1 + Total 2. 180 hours Max.)*	**150**	