Universidad Carlos III de Madrid
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COURSE: ELECTRONIC SYSTEMS		
DEGREE: COMMUNICATIONS SYSTEMS ENGINEERING	**YEAR: 3**	**TERM: 1**

The course has 27 sessions spread over 14 weeks. The theory and exercises sessions will last 100min. The laboratories are located on the same schedule of small group sessions and will last 150 min. Every week the student will have two sessions.

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	GROUPS (mark X)		SPECIAL ROOM FOR SESSION (Computer class room, audio-visual class room)	Indicate YES/NO If the session needs 2 teachers	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h week)
1	1	**Course introduction** **Chapter 1: Revision of the Basic Concepts of Electronic Amplifiers** 1.-Revision of the concepts related to: -Gain (Av), -Input impedance (Ri), -Output impedance (Ro) and -Bandwidth (BW). 2.-Single stage amplifier example: DC analysis, Av, Ri, Ro and BW.	x			NO	Review of theory covered in Chapter 1. Complete proposed application examples (analysis of feedback amplifiers) (amplifiers analysis and Bode diagram representation)	1,66	7
1	2	**Exercises related to Chapter 1: Revision of the Basic Concepts of Electronic Amplifiers.** Application example of a multistage amplifier. Frequency response. Bode diagram representation		x		NO		1,66	

2	3	**Chapter 2: Feedback Electronic Circuits. (I)** 1.-Basic concepts of the theory related to feedback electronics. 2.-Electronic feedback circuit topologies: -Series – Shunt topology. -Shunt – Shunt topology. -Shunt - Series topology. - Series – Series topology. 3.-Calculation of the gain, input impedance and output impedance in feedback circuits.	x			NO	Study of the theory covered in Chapter 2. Complete proposed application examples (analysis of feedback amplifiers).	1,66	6
2	4	**Exercises related to Chapter 2 (I): Feedback Electronic Circuits.** 1.-Conception of the practical or approximate method used to solve negative feedback circuits 2.-Examples		x		NO		1,66	
3	5	**Chapter 2: Feedback Electronic Circuits (II).** 3.-Basic configurations of the beta network according to the different topologies. 4.-Study of feedback circuits for each one of the different topologies.	x			NO	Complete proposed application examples of Chapter 2 (analysis of feedback amplifiers)	1,66	6
3	6	**Exercises related to Chapter 2 (II): Feedback Electronic Circuits.** Exercises and problems related to real feedback circuits.		x		NO		1,66	
4	7	**Chapter 3.-Frequency Analysis of Electronic Feedback Circuits.** 1.-Frequency analysis of a feedback amplifier: -with a single pole. -with 2 and 3 poles. 2.-Stablility study of a feedback amplifier using the Bode diagram	x			NO	Study of the theory covered in Chapter 3. Complete proposed application examples (stability study and frequency compensation methods for feedback amplifiers)	1,66	6
4	8	**Exercises related to Chapter 3: Frequency Analysis of Feedback Electronic Circuits** Compensation Methods. Exercices -Beta network modification. -Dominant pole compensation. -Pole – Zero compensation.		x		NO		1,66	
5	9	**Chapter 4.- Sinusoidal Oscillators (I)** 1.-Start up condition and oscillator maintenance. 2.-General configuration of an oscillator. 3.-RC oscillators: -Wien Bridge Oscillator. -Phase shift network oscillator. 4. Amplitude limiters	x			NO	Study of the theory covered in Chapter 4. Complete proposed application examples (sinusoidal oscillators analysis)	1,66	6
5	10	**Chapter 4: Sinusoidal Oscillators (II).** 5.- LC Oscillators: -Colpitts Oscillator. -Hartley Oscillator. -Clapp Oscillator. 6.-Crystal Oscillators (Xtal) -Crystal characteristics (Xtal) piezoelectrics. -Series and shunt crystal resonant frequencies. -Crystal oscillator schemes.		x		NO		1,66	
6	11	FREE (tutorial)	x			NO	**Exam 1 Preparation**		7
6	12	**Application Exercises for Chapter 4: Problems RC, LC and Xtal Oscillators.**		x		NO		1,66	

7	13	**Chapter 5: Operational Amplifier and Application Circuits, and examples (I)** - Ideal Operational Amplifier (review) - Real Operational Amplifier o DC Errors (voltage Offset, bias currents and Offset) o Medium frequency characteristics (input and output resistance, differential gain, CMRR) o Maximum output current o Gain Bandwidth Product (GxBW) o Slew Rate (SR) **Exam 1 (50 min) Chapters 2-4**	x			NO	Study of the theory covered in Chapter 5. Complete proposed application examples (real opamps, linear and non-linear application circuits)	1,66	5
7	14	**Chapter 5: Operational Amplifier and Application Circuits, and examples (II)** - Linear Applications (review) o Voltage amplifier o Summer o Differential Amplifier and Instrumentation Amplifier o Transimpedance and Transadmittance Amplifier - Non linear applications (I) o Log and Antilog Amplifier o Precision rectifiers o Peak detectors		x		NO		1,66	
8	15	**Chapter 5: Operational Amplifier and Application Circuits, and examples (III)** - Active filters as linear application o Ideal and real integrator. Ideal and real Differentiator o First order circuits. Low pass, High pass, PI o Second order circuits. Sallen-Key	x			NO	Study of the theory covered in Chapter 5. Complete proposed application examples (active filters, comparators and relaxation oscillators) Study of the theory covered in Chapter 6 (Structure and functioning principle as monostable) **Lab Session 1 preparation** (detailed reading of manual and development of previous calculations)	1,66	7
8	16	**Chapter 5: Operational Amplifier and Application Circuits, and examples (IV)** - Non linear applications (II) o Simple comparator o Comparator with hysteresis (Schmitt Trigger) o Relaxation oscillator **Chapter 6. The 555 integrated timer and Examples (I)** - Structure and functioning principles - Monostable		x		NO		1,66	
9	17	**Chapter 6. The 555 integrated timer and Examples (II)** - Astable and VCO - Application examples	x			NO	Complete proposed examples for Chapter 6 (applications of 555 timer) **Lab Session 2 preparation** (detailed reading of manual and development of previous calculations)	1,66	6
9	18	**Lab Session 1**		x	LAB	YES		2,5	
10	19	**Chapter 7: PLLs (I)** - Blocks diagram and working principle. - PLL components: phase detector, filter (first order), VCO. - PLL transfer function. PLL types.	x			NO	Study of the theory covered in Chapter 7. Complete proposed application examples (PLL components: phase detector, filter (first order), VCO).	1,66	4
10	20	**Lab Session 2**		x	LAB	YES		2,5	

11	21	**Chapter 7: PLLs (II)** - 1st order PLL. Examples. - 2nd order PLL. Examples. - PLL Applications.	x			NO	Study of the theory covered in Chapter 7. Complete proposed application examples (1st and 2nd order PLLs and PLL applications). **Lab Session 3 preparation** (detailed reading of manual and development of previous calculations).	1,66	6
11	22	**Application Exercises for Chapter 7: PLLs**		x		NO		1,66	
12	23	**Chapter 8: Linear Voltage Regulators and Switching DC/DC Converters (I).** - Series – Shunt feedback in linear voltage regulators. - Basic design of a linear voltage regulator. - Power and efficiency calculations.	x			NO	Study of the theory covered in Chapter 8 (Linear Voltage Regulators). **Exam 2 Preparation.**	1,66	7
12	24	**Lab Session 3**		x	LAB	YES		2,5	
13	25	**Chapter 8: Linear Voltage Regulators and Switching DC/DC Converters (II).** - Fundamentals of switching DC/DC Converters. - Basic operation of Buck converter. **Exam 2 (50 min) Chapters 5-7.**	x			NO	Study of the theory covered in Chapter 8 (switching DC/DC Converters). Complete proposed application examples (Linear Voltage Regulators and Switching DC/DC Converters). **Lab Session 4 preparation** (detailed reading of manual and development of previous calculations).	1,66	6
13	26	**Application Exercises for Chapter 8: Linear Voltage Regulators and Switching DC/DC Converters.** - Basic design of Buck converter. - Negative feedback in a switching DC/DC Converters.		x		NO		1,66	
14	27	**Chapter 9: energy systems for Telecommunications. Specifications, regulations and Topologies.** - DC/DC and AC/DC Converters for Telecommunications. - Uninterruptible power supply systems (UPS) for Telecommunications. **Chapter 10: Energy Converters. Solar photovoltaic, eolic, others.** - Basic analysis of a photovoltaic generator - Basic analysis of the eolic generator. - Description of other Systems related to electrical energy generation.	x			NO	Study of the theory covered in Chapter 8. **Lab final report generation.**	1,66	6
14	28	**Lab Session 4 . Lab exam.**		x	LAB	YES		2,5	
							Subtotal 1	**48,33**	**85**
							Total 1 *(Hours of class plus student homework hours between weeks 1-14)*	131,33	

15		Tutorials, handing in, etc					Tutorial	1,66	
16-18		Assessment						3	12
							Subtotal 2	**3**	
							Total 2 *(Hours of class plus student homework hours between weeks 15-18)*	18,66	

TOTAL *(Total 1 + Total 2. Maximum 180 hours)*	**150**