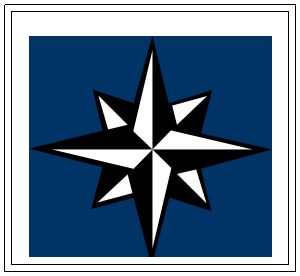

Teaching Plan for the Subject

Educational Guide

Programming of Activities

Electronic Circuits and Transmission Media

Educational Guide

1. Descriptive data of the subject

- **Academic year:** 2011 – 2012
- **Name of the subject:** Electronic Circuits and Transmission Media
- **Code:** 21607
- **Type of subject:** obligatory
- **Degree:** Bachelor's degree in Audiovisual Systems Engineering
- **Number of credits:** 5
- **Number of ECTS:** 4
- **Total number of hours of dedication to the subject:** 100
- **Timing:**
  - Course: 2n course
  - Type: trimestral
  - Period: 3rd trimester
- **Coordinator:** Rafael Pous
- **Teachers:** Rafael Pous, Ausias Vives, Quim Castellví, Toni Ivorra
- **Departament:** Dept. de les Tecnologies de la Informació i les Comunicacions
- **Groups:** see the ESUP website
- **Teaching language:** catalan
- **Building where the subject is taught:** see the ESUP website
- **Schedule:** see the ESUP website

2. Presentation of the subject

Transmission Media and Electronic Circuits is an introductory and theoretical and practical subject in which the basic fundamentals of electronic circuits are studied. The blocks that are studied are the following:

- Basic analysis of circuits
- Analysis and design of logic doors
- Nonlinear circuits and amplifiers
- Permanent sinusoidal regime and filters
- Operational amplifiers

3. Prerequisites for the follow-up of the training itinerary

For the correct follow-up of the subject, it is necessary to have a solid foundation in mathematics and physics (at the level of second of Baccalaureate). On the other hand it is considered that the student has taken advantage of at least the first term of the subject Ones and Electromagnetism (21296).

The necessary competences and prior knowledge are the following:

- - Operations with complex numbers
- - Vector algebra and matrices
- - Basic calculation of derivatives and integrals.
- - Resolution of equations and systems of linear equations
- - Basic concepts of electromagnetism: electric field and magnetic field
- - Know the international system of units and the scientific notation.

4. Skills to be achieved in the subject

General competences	Specific competences
Instrumental 1. Analysis 2. Troubleshooting 3. Creativity **Interpersonal** 1. Teamwork 2. Written communication **Systemic** 1. Capacity to estimate and schedule work 2. Transfer of theoretical knowledge to practical 3. Responsibility for the quality in the accomplishment of the tasks **Others** 1. Motivation for success and personal satisfaction	1. Use basic models of the constants circuits located for resistance, sources, inductances, capacities and transistors. 2. Analyze circuits that include linear elements of constant localization (linear lumped elements). Specifically, analyze circuits that contain resistors and independent sources using techniques such as knots, overlays and thevenin method. 3. Use Boolean algebra to describe the function of logic circuits. 4. Design circuits that represent expressions of digital logic. Specifically, design digital circuits at the gate-level level to implement a Boolean function. 5. Check the static specifications of the circuits. For example, determine if the circuit that represents a logical gate provides the appropriate noise margins. 6. Determine the output produced by a given circuit by a set of inputs using the resistive model of a MOSFET. 7. Perform small signal analysis of an amplifier using small signal models for all elements of the circuit. 8. Analytically describe the temporal behavior of first and second order circuits that contain resistors, capacities and inductors. 9. Build resistive circuits, simple doors and amplifiers in the laboratory. 10. Determine the frequency behavior of circuits with resistors, coils and capacities in the laboratory. 11. Use models of operational amplifier in circuits with negative feedback. 12. Design, build and verify an electronic system which includes components analog and digital.

5. Learning objectives

Apart from the specific competences derived from the contents, the Subject of Transmission and Electronic Circuits is designed to give the student a

series of competitions that will be very useful throughout the entire race. Therefore, in this subject you want to achieve:

- - Understand the basic principles of electrical engineering as well as the abstractions used in the design of electronic systems. These include models of circuits with concentrated elements ("lumped circuit models"), permanent sinusoidal regime, digital circuits and operational amplifiers.
- - Use the abstractions of engineering to analyze and design basic electronic circuits.
- - Formulate and solve differential equations by describing the temporal behavior of circuits that contain energy storage elements.
- - Use the intuition to describe the temporal behavior of circuits that contain energy storage elements.
- - Understand the concept of using a simple model to represent nonlinear and active elements that are found in the circuits, such as the MOSFET transistors.
- - Build circuits and extract measurements of circuit variables using tools such as oscilloscopes, multimeters and signal generators. Compare and analyze the experimental measures with the behavior predicted by the mathematical models.
- - Understand the relationship between the mathematical representation of the behavior of a circuit and the corresponding real effects.
- - Appreciate the practical meaning of electronic systems developed throughout the course.

6. Evaluation

For the evaluation of the subject there is a single itinerary, in which the note is calculated based on:

- - Laboratory (20%): There will be 8 deliveries (4 previous studies and 4 memoirs). The minimum grade to approve the Laboratory is 4. The attendance to the practices is an indispensable requirement to pass the subject. Only in exceptional and justified cases can you choose to recover the practice, always before the final exam. A practice grade of less than 4 or non-attendance to some practice implies the impossibility of passing the subject in September, because the practices can not be approved during the summer.
- - Problems (20%): 3 deliveries will be made individually. Each delivery will have at least 4 problems and will be corrected and scored at least 2. The minimum grade to pass Problems is 4. A problem note of less than 4 implies the impossibility of passing the subject in September, because Problems can not be approved during the summer.
- - Partial Exam (30%): Not eliminatory, covering the subject seen until the week before the exam.
- - Final Exam (30%): It will include all the subject matter, including the previous one in the Partial Exam. The minimum mark to the Final Exam to pass the subject is 4.

Having passed practicals and problems, but having suspended the course or having obtained a grade less than 4 in the Final Exam, you can opt for the September exam. The September exam note will count 60%, and together with

the mark of practices (20%) and problems (20%), will be used to calculate the mark of the subject in the convocation of September.

7. Contents

The Subject of Transmissions and Electronic Circuits considers a series of contents that will be worked to achieve the competencies set out in the previous section. The subject consists of 5 large blocks:

- **Content block 1. - Basic analysis of circuits**
  - Introduction and concentrated elements
  - Basic method of analysis of circuits (KVL and KCL)
  - Superposition, Thévenin and Norton
- **Content block 2. - Analysis and design of logic doors**
  - Digital abstraction and the interior of logic doors
  - Transient capacitive of first order and speed of digital circuits
- **Content block 3. - Nonlinear circuits and amplifiers**
  - Non-linear analysis
  - Incremental analysis
  - Dependent sources and amplifiers
  - High signal analysis of the MOSFET amplifier
  - Model in small signal of the amplifiers
- **Content block 4. - Permanent sinusoidal regime and filters**
  - Permanent sinusoidal regime and the impedance model
  - Transfer function and filters
- **Content block 5. - Operational amplifiers**

8. Methodology

Transmission Media and Electronic Circuits have 5 credits (or 4 ECTS credits) that correspond to 100 hours of work, of which only 36 are face-to-face. These 36 hours are divided into: theory (18 hours), seminars (10 hours) and laboratory practices (8 hours).

8.1. Theory

- The theoretical classes will present the fundamental concepts of the subject.
- Theory classes will be in large group (all groups together).
- Assistance is mandatory in principle.
- For each hour of theory, there are some previous readings of the textbook, which must be done before each class.

8.2. Seminars

- The seminars are intended for discussion of problems previously worked by the students. The teacher will solve the doubts that have arisen.
- Seminar classes will be held in middle groups.
- Assistance is mandatory in principle.
- The teaching material will be published weekly in the space of the subject of the Classroom Global.
- Every two weeks the student will have to the professor to the professor all the problems announced in the Global Classroom. The teacher will randomly correct a minimum of two who will count as a note of problems.
- The delivery of the problems will count as a partial note of the whole subject (note of problems).

- The Global Classroom will be informed of the maximum delivery dates. Deliveries after this date will be considered void. All deliveries will have to be done during theory classes, in ma teacher.

8.3. Laboratory practices

- Laboratory practices are intended for carrying out practical exercises using electronic measuring equipment.

- The laboratory classes will be in small groups.

- Assistance is absolutely mandatory, and an essential requirement to pass the course.

- The teaching material will be published weekly in the space of the subject of the Classroom Global.

- Before each laboratory session, the student will give the teacher previous studies. After each laboratory session, the teacher will give the practical reports.

- The practical reports must be delivered no later than 10 days after the laboratory session.

- The Global Classroom will be informed of the maximum delivery dates. Deliveries after this date will be considered void. All deliveries will be made through the Aula Global.

8.4. Tutorials

Available hours for solving doubts on the site and the hours announced in the Global Classroom.

9. Sources of information and didactic resources

9.1. Basic bibliography

- Anant Agarwal and Jeffrey Lang, course materials for 6.002 Circuits and Electronics, Spring 2007. MIT OpenCourseWare (http://ocw.mit.edu/), Massachusetts Institute of Technology.
- Agarwal, Anant, and Jeffrey H. Lang. *Foundations of Analog and Digital Electronic Circuits*. San Mateo, CA: Morgan Kaufmann Publishers, Elsevier, July 2005. ISBN: 9781558607354.

9.2. Reinforcement bibliography

- Tipler, P. A., Física, vol. I i II, Editorial Reverté.
- Giró, A., Canales, M., Rey, R., Sesé, G:, Tullàs, J., Física per a estudiants d'informàtica, Edicions de la UOC – Edicions UPC.

9.3. Planning of activities

Week	CEMT Day		Group 1	2	3	4	Topic	Reading	HW Publ.	Due
1	Tuesday, April 10	12:30-13:30								
		13:30-14:30								
	Tuesday, April 10	18:30-19:30								
		19:30-20:30								
	Wednesday, April 11	14:30-15:30	I	I	I	I	Introduction and lumped abstraction	Chap. 1		
		15:30-16:30	S	S						
	Friday, April 13	16:30-17:30	I	I	I	I	Basic circuit analysis method (KVL and KCL Method)	Chap. 2.1-2.5, 3.1-3.3		
		17:30-18:30			S	S				
2	Tuesday, April 17	12:30-13:30	P				Lab 1: Introduction to the Electrical Engineering laboratory		HW1	
		13:30-14:30	P							
	Tuesday, April 17	18:30-19:30		P						
		19:30-20:30		P						
	Wednesday, April 18	14:30-15:30	I	I	I	I	Superposition, Thevenin and Norton	Chap. 3.5-3.6		
		15:30-16:30			S	S				
	Friday, April 20	16:30-17:30	I	I	I	I	The digital abstraction & inside the digital gates	Chap. 5.1, 6.1-6.8		
		17:30-18:30	S	S						
3	Tuesday, April 24	12:30-13:30			P		Lab 1: Introduction to the Electrical Engineering laboratory			
		13:30-14:30			P					
	Tuesday, April 24	18:30-19:30				P				
		19:30-20:30				P				
	Wednesday, April 25	14:30-15:30	I	I	I	I	First order capacitor transients & digital circuit speed	Chap. 9.1, 10.1-10.4		
		15:30-16:30	S	S						
	Friday, April 27	16:30-17:30	I	I	I	I	Review			
		17:30-18:30			S	S				
4	Tuesday, May 01	12:30-13:30								HW1
		13:30-14:30								
	Tuesday, May 01	18:30-19:30								
		19:30-20:30								
	Wednesday, May 02	14:30-15:30	I	I	I	I	Nonlinear analysis	Chap. 4.1-4.3		
		15:30-16:30			S	S				
	Friday, May 04	16:30-17:30	T	T	T	T	Incremental analysis	Chap. 4.5		
		17:30-18:30	S	S						
5	Tuesday, May 08	12:30-13:30	P				Lab 2: Design and construction of a peak detector		HW2	
		13:30-14:30	P							
	Tuesday, May 08	18:30-19:30		P						
		19:30-20:30		P						
	Wednesday, May 09	14:30-15:30	I	I	I	I	Dependent sources and amplifiers	Chap. 2.6, 7.1-7.2		
		15:30-16:30	S	S						
	Friday, May 11	16:30-17:30	I	I	I	I	MOSFET amplifier large signal analysis	Chap. 7.3-7.7		
		17:30-18:30			S	S				
6	Tuesday, May 15	12:30-13:30			P		Lab 2: Design and construction of a peak detector			
		13:30-14:30			P					
	Tuesday, May 15	18:30-19:30				P				
		19:30-20:30				P				
	Wednesday, May 16	14:30-15:30	S	S			Review			
		15:30-16:30			S	S	Review			
	Friday, May 18	16:30-17:30	E	E	E	E				
		17:30-18:30	E	E	E	E				
7	Tuesday, May 22	12:30-13:30	P				Lab 3: Simulation and construction of a sound amplifier and peak detector			HW2
		13:30-14:30	P							
	Tuesday, May 22	18:30-19:30		P						
		19:30-20:30		P						
	Wednesday, May 23	14:30-15:30	T	T	T	T	Amplifiers small signal model	Chap. 8		
		15:30-16:30			S	S				
	Friday, May 25	16:30-17:30	I	I	I	I	Sinusoidal steady state and the impedance model I	Chap. 13.1-13.2		
		17:30-18:30	S	S						
8	Tuesday, May 29	12:30-13:30			P		Lab 3: Simulation and construction of a sound amplifier and peak detector			HW3
		13:30-14:30			P					
	Tuesday, May 29	18:30-19:30				P				
		19:30-20:30				P				
	Wednesday, May 30	14:30-15:30	I	I	I	I	Sinusoidal steady state and the impedance model II	Chap. 13.3		
		15:30-16:30	S	S						
	Friday, June 01	16:30-17:30	I	I	I	I	Transfer functions and filters	Chap. 13.4-13.5		
		17:30-18:30			S	S				
9	Tuesday, June 05	12:30-13:30	P				Lab 4: Design and construction of the system			
		13:30-14:30	P							
	Tuesday, June 05	18:30-19:30		P						
		19:30-20:30		P						
	Wednesday, June 06	14:30-15:30	I	I	I	I	Operational amplifier abstraction and circuits I	Chap. 15.1-15.3		
		15:30-16:30			S	S				
	Friday, June 08	16:30-17:30	I	I	I	I	Operational amplifier abstraction and circuits II	Chap. 15.4-15.6		
		17:30-18:30	S	S						
10	Tuesday, June 12	12:30-13:30			P		Lab 4: Design and construction of the system			HW3
		13:30-14:30			P					
	Tuesday, June 12	18:30-19:30				P				
		19:30-20:30				P				
	Wednesday, June 13	14:30-15:30	S	S			Review			
		15:30-16:30			S	S	Review			
	Friday, June 15	16:30-17:30	T	T	T	T	Review			
		17:30-18:30	I	I	I	I	Review			
11	Tuesday, June 19	12:30-13:30								
		13:30-14:30								
	Tuesday, June 19	18:30-19:30								
		19:30-20:30								
	Wednesday, June 20	14:30-15:30								
		15:30-16:30								
	Friday, June 22	16:30-17:30								
		17:30-18:30								

T	18	18	18	18	(Teoria) Class lectures. All groups together.
S	10	10	10	10	(Seminari) HW resolution classes. Separate groups.
P	8	8	8	8	(Pràctiques) Labs. Separate groups.
Subtotal	*36*	*36*	*36*	*36*	*Total in-class hours*
E	2	2	2	2	(Examen) Quizzes. All groups together.
H	24	24	24	24	Homework hours at home (3 per HW assignment)
L	16	16	16	16	Lab preparation hours at home (4 per lab assignment)
Q	22	22	22	22	Quizz and exam study hours at home (8 quizz, 14 exam)
Total	**100**	**100**	**100**	**100**	**Total effort in hours**