

TITLE OF COURSE: Electronics I

PROGRAM TITLE: Engineria Tècnica de Telecomunicació Especialitat Telemàtica, 1st grade

CODE: 41011 program of Engineria Tècnica de Telecomunicació Especialitat Telemàtica

TYPE: T **YEAR:** 1st year **SEMESTER:** Not available

CREDITS (hours/week): 12.00

ECTS CREDITS: 9.00

LECTURER: C. Garriga, J. Albó, S. Cantos, X. Margalef, X. Senmartí

LANGUAGE: Catalan

PREREQUISITES: None

PREVIOUS KNOWLEDGE: Elementary Electric Physics, Mathematics and Algebra.

SUBJECTS TO BE STUDIED SIMULTANEOUSLY: Not available

COURSE DESCRIPTION:

First the student sees the basics electronic concepts and the necessary techniques for circuit analysis in a temporal domain. After that, students study the different electronic components (lineal resistors, capacitors, inductors, diodes, transistors,...) in ideal and real form. In this process, students look for information in manufacturers' documents.

COURSE OBJECTIVES:

- 1 Develop the basic knowledge of the area of study.
- 2 Develop the capacity for analysing and synthesizing electronic assemblies.
- 3 Develop the capacity to search for information from differents manufacturers
- 4 Develop the capacity to plan a large amount of work.
- 5 Promote group work in order to distribute tasks and to mutually help each other if any problems appears.
- 6 Develop the capacity to use and interpret information from differents subjects.

CONTENTS:

- 1 INTRODUCTION TO DC CIRCUITS
 - 1.1 Foundations of electrical physics.
 - 1.2 Voltage, current and resistance. Ohm's Law.
 - 1.3 Series and parallel circuits. Open-circuits and short-circuits.
 - 1.4 Voltage sources and current sources.

- 2 DC CIRCUITS ANALYSIS
 - 2.1 Superposition's theorem.
 - 2.2 Kirchhoff's Laws.
 - 2.3 Thevenin's theorem and Norton's theorem.

- 3 RESISTORS
 - 3.1 Resistor and resistance.
 - 3.2 Technical characteristics. Data sheets.
 - 3.3 An overview of the market's linear resistors.

- 3.4 Non-linear resistors: NTC resistors, PTC resistors , VDR and LDR.
- 4 CAPACITORS
 - 4.1 Capacitor and capacitance.
 - 4.2 DC analysis. First order circuits (RC).
 - 4.3 An overview of the market's linear capacitors.
- 5 INDUCTORS
 - 5.1 Inductor and inductance.
 - 5.2 DC analysis. First order circuits (RL).
- 6 INTRODUCTION TO AC CIRCUITS
 - 6.1 Periodic waveforms.
 - 6.2 RMS, average and peak values.
 - 6.3 Phasor diagrams and complex impedances.
 - 6.4 RLC circuits.
 - 6.5 AC circuits power.
- 7 AC CIRCUITS ANALYSIS
 - 7.1 Introduction.
 - 7.2 Superposition's theorem.
 - 7.3 Kirchoff's laws.
 - 7.4 Thevenin's theorem and Norton's theorem.
 - 7.5 Maximum power transfer theorem.
- 8 EQUIVALENT CIRCUITS IN AC
 - 8.1 Resistor. Equivalent circuits.
 - 8.2 Capacitor. Equivalent circuits.
 - 8.3 Inductor. Equivalent circuits.
 - 8.4 Ideal transformer.
- 9 SEMICONDUCTOR DIODES
 - 9.1 Ideal diode.
 - 9.2 Semiconductor materials. N-type and P-type extrinsic materials.
 - 9.3 Semiconductor diode. Transfer characteristics.
 - 9.4 Static and dynamic resistances.
 - 9.5 Zener diode.
 - 9.6 Photodiode.
 - 9.7 LED.
 - 9.8 Diode's linear models and analysis.
- 10 BIPOLAR JUNCTION TRANSISTOR
 - 10.1 Introduction.
 - 10.2 Transistor's currents in forward active. Amplifying action.
 - 10.3 Transistor's configurations. Transfer characteristics.
 - 10.4 Forward active, saturation and cut-off.
- 11 BJT BIASING
 - 11.1 Operation point (Q).
 - 11.2 Static and dynamic load lines.
 - 11.3 Q to maximize the output voltage swing in the linear region.
 - 11.4 Stabilized bias circuits.

12 BJT SMALL-SIGNAL ANALYSIS

- 12.1 Miller's theorems.
- 12.2 The hybrid equivalent model. Determination of h-parameters.
- 12.3 Simplified common-emitter equivalent model.
- 12.4 Common-emitter amplifiers.
- 12.5 Common-base amplifiers.
- 12.6 Common-collector amplifiers.
- 12.7 Amplifiers with several transistors.

13 FIELD-EFFECT TRANSISTOR

- 13.1 Junction-FET.
- 13.2 Transfer characteristics (JFET).
- 13.3 JFET biasing.
- 13.4 JFET small-signal model.
- 13.5 MOSFET.
- 13.6 An introduction to digital circuits with MOSFET.

METHODOLOGY:

The methodology used in this subject is based on complementary theoretical classes with practices in the laboratory (Electronic Technology - code:41131 -).

There are classes where the subject's theoretical contents are explained and which are complemented with related problems. In each theory theme, problems are posed for the students do them at home and hand them in to the teacher for a continuous evaluation. Some of these theoretical classes are also dedicated to posing problems for the students to solve in class, with the objective of making students actively participate in these classes.

In order to improve the student's yield they are offered the possibility of making customized consultations on the subject, at a contents level, or to do with anything related (studying techniques, practical designs, correction of problems posed...).

The subject is evaluated by means of:

- A. Exams.
- C. Test type exams.
- D. Assignments and Reports done.
- F. Reports/Assignments in group.
- J. Participation in class.

The structure of the subject will be with trimestral partial notes that release content.

The marks for the partials will be calculated proportionally to the mark of the terms' exam, with a proportion of 70%, and the mark from continuous evaluation, with a proportion of 30%.

The partials will release matter until June, and with a minimum note of Four (4), being necessary for the average of the three partials to be equal or superior to Five (5) in order to pass the subject.

In June there will be the possibility of doing recuperation exams of the first partials for those students who have not passed them previously, these exams marks is a 100% of the mark of the corresponding partials.

As an exception, since there is no recuperation exam for the third partial in June, the mark for this third partial will be the best one obtained with the following calculations:

- a) 70% of terms exam and 30% of the continuous evaluation.
- b) 100% of the term exam

The students who do not pass in June will have to make a global exam of all the subject in September, except those students whom they have released first and second partials and only they need third, who will be able to do an exam of recuperation of the third partial and to make average with other obtained notes of the first and second partials. The September notes will be the 100% of the note of the exam.

- the continuous note of valuation will be determined considering the following concepts:
- Results of the controls and/or small tests that become in class.
- Delivery of proposed exercises to do in class.
- Delivery of proposed exercises to do in house.
- Attendance, attitude and participation in class.
- the note will be in a 70% of the knowledge demonstrated in the given controls, exercises, and 30% rest as criterion of the professor (attendance in class, interest, attitude, dedication...).

EVALUATION:

The subject to evaluate by means of:

- A. Exams.
- C. Exams type test.
- D. Done Works And Informs.
- F. Informs/Work in group.
- J. Participation in class.

The structure of the subject will be with trimestral partial notes that release content.

The marks of the partials will be calculated proportional the note of the trimestraly exam, with a proportion of 70%, and the mark of continuous evaluation, with a proportion of 30%.

The partials will be released of matter until June, and with minimum note of Four (4), being necessary that the average of the three partials is equal or superior to Five (5) to pass the subject.

In June there will be the possibility both of making examinations of recovery of first partials for those students who have not released them previously, being the note of these examinations the 100% of the note of the corresponding partials.

Like exception, since there is no exam of recovery of the third partial in June, the note of this third partial will be the best one of the obtained one with the following calculations:

- a) 70% of trimestral exam and 30% of the continuous evaluation.
- b) 100% of the trimestral exam

The students who do not pass in June will have to make a global exam of all the subject in September, except those students whom they have released first and second partials and only they need third, who will be able to do an exam of recuperation of the third partial and to make average with other obtained notes of the first and second partials. The September notes will be the 100% of the note of the exam.

- the continuous note of valuation will be determined considering the following concepts:
- Results of the controls and/or small tests that become in class.
- Delivery of proposed exercises to do in class.
- Delivery of proposed exercises to do in house.
- Attendance, attitude and participation in class.
- the note will be in a 70% of the knowledge demonstrated in the given controls, exercises, and 30% rest as criterion of the professor (attendance in class, interest, attitude, dedication...).

PERFORMANCE CRITERIA:

Objective 1

Students must prove to have the necessary knowledge related to the subject.

Objective 2

Students must know how to solve, interpret and design any problem in the scope of the electronics which he may be asked. [A, C, D, and, F]

Students must have the capacity of processing the numerous data which they think of in doing the exercises, synthesizing and choosing the best procedures to solve problems.

[F]

Objective 3

Students must be used to working with manufacturers real data . [A,C,D,E,F]

Objective 4

Students must have the capacity of planning their tasks related to the exercises in order to be able to hand them in within the established the terms and pass the periodic tests.

[D,J]

Objective 5

Students must have the capacity for work organization and promoting team work. They must have the capacity to solve any problem applying their knowledge [J]

Objective 6

Students must obtain a certainty in the work and the contents assimilation so for the acquisitions of knowledge to be progressive.[J]

TEXTBOOKS:

Col·lecció de Problemes, Enginyeria La Salle, 2004

Pràctiques de Tecnologia Electrònica, Enginyeria La Salle, 2004

OTHER REQUIRED MATERIAL:

-Millman & Halkias, Electronics. Foundations and applications, Hispanic European, 1993

-Boylestad & Nashelsky, Electronics. Theory of circuits, Prentice-Hall the International, 1997

-Millman & Grabel, Microelectronics, Hispanic European, 2000

-Malvino, discreet and integrated Principles of Electronics, McGraw-Hill, 1997

-Schilling & Relove, Electronic circuits, Publishing Marcombo Boixareu, 1985

-M.M. Cirovic, fundamental Electronics; devices, circuits and systems, 1985

-M.A. Castro, S.F. Garcia, P.M. Martínez, S. Martínez, R. Sebastián, F. Yeves, Problemas de Electrónica, Marcombo, 1991

-R. Álvarez Santos, Materiales y componentes electrónicos, Escuela de Ingeniería Técnica de Telecomunicación de Madrid, 1993

-Basic Analyses of Circuits in Engineering. Irwin. Ed. Limusa 2005

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UPDATED: 21/04/2005

REMARKS:

In the actual Spanish educational system the duration of courses can be one or two semesters. This fact was fixed for each curriculum when it was approved by the Spanish

government and published in the Official Bulletin of the State (BOE). To continue to have the Spanish recognition it is necessary to maintain the structure approved by the Ministry. Nevertheless, all our degrees have a structure that allows us to have global evaluations of the knowledge acquired by the student at the end of each semester. So, for those foreign students that spend only one semester in our university, under Erasmus or other international programs in which Ramon Llull University is involved, these evaluations will serve the student to achieve the credits allocated during such a semester.