UAB
Universitat Autònoma de Barcelona

Foundations of Signals and Systems

Code: 102690
ECTS Credits: 6

2025/2026

Degree	Type	Year
Electronic Engineering for Telecommunications	FB	1
Telecommunication Systems Engineering	FB	1

Contact

Name: Rosana Rodriguez Martinez

Email: rosana.rodriguez@uab.cat

Teachers

Javier Martin Martinez

Eden Francisco Corrales Lopez

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

The student must have an adequate level of calculus (real and complex variable functions, complex numbers, differentiation and integration) and basic circuit theory (Kirchhoff laws, Thévenin-Norton equivalents, superposition principle, voltage-current laws of elementary devices and basic circuital analysis).

Objectives and Contextualisation

- Introduce the student to the analysis and characterization of signals and systems, with emphasis on linear systems.
- Learn the Laplace transform and its properties.
- Learn how to apply the Laplace transform to circuit analysis.
- Learn and apply the concept of transfer function of an LTI system.
- Learn how to obtain the Bode diagram of a system.
- Learn the Fourier transform and its properties.
- Learn how to apply the Fourier transform to periodic signals (Fourier series) and the limitation in time (windowing) and frequency (Gibbs phenomenon).

Learning Outcomes

1. KM15 (Knowledge) Interpret the basic properties of analog and digital modulation systems.
2. KM15 (Knowledge) Interpret the basic properties of analogue and digital systems.
3. KM17 (Knowledge) Estimate the effects of analogue and digital signal filtering.
4. KM17 (Knowledge) Estimate the effects of signal filtering, both at the analogue and digital level.
5. SM12 (Skill) Apply the basic concepts of linear systems and related functions and transforms to analyze and solve problems in the field of engineering.
6. SM12 (Skill) Apply the basic concepts of linear systems and related functions and transforms to analyze and solve problems in the field of engineering.

Content

1. Introduction to the subject. Signals and systems.
    1. Signals. Independent variable transforms and basic signals.
    2. System properties: linearity, invariance, causality and stability.
    3. Linear and time invariant systems (LTI). Convolution equation.

1. The Fourier transform.
    1. Definition of the Fourier transform.
    2. Transform of basic signals.
    3. Properties of the Fourier transform.
    4. Limitation in frequency (Gibbs phenomenon) and limitation in time (windowing).
    5. Fourier transform of periodic signals. The Fourier series.

1. The Laplace transform.
    1. Laplace transform. Definition. Properties.
    2. Solution of differential equations using the Laplace transform.
    3. Obtaining the inverse Laplace transform.

1. Applications of the Laplace transform.
    1. Analysis of circuits with capacitors and inductors.
    2. Transfer function of a system. Definition and obtention of the impulse response.
    3. Pole and zero diagrams and system stability.
    4. Permanent response of a system. Bode diagrams.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Autonomous work	75	3	KM15, SM12, KM15
Master class	20	0.8	KM15, SM12, KM15
Problem solving	15	0.6	SM12, SM12
Summary lessons	10	0.4	KM15, SM12, KM15
Type: Autonomous			
On-line problems solving	10	0.4	KM15, SM12, KM15

The course consists of:

- Master classes where the teacher explains the basic concepts of the subject.
- Problem solving classes where the teacher solves problems on the blackboard.
- Guided problem classes, where the students solve the problems and the teacher supervises and solves doubts.
- Troubleshooting online.
- The communication tool with the students will be the UAB Virtual Campus: https://cv.uab.cat.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
On-line problems solving (Pol4r)	2,5%	2.5	0.1	KM15, SM12
On-line problems solving 1 (Pol1r)	2,5%	2.5	0.1	KM15, SM12
On-line problems solving 2 (Pol2r)	2,5%	2.5	0.1	KM15, SM12
On-line problems solving 3 (Pol3r)	2,5%	2.5	0.1	KM15, SM12
Recuperation exam chapters 1-4 (Pr1, Pr2)	90%	4	0.16	KM15, KM17, SM12
Written exam chapter 1 (P1)	45%	3	0.12	KM15, KM17, SM12
Written exam chapter 3 and 4 (P2)	45%	3	0.12	KM15, KM17, SM12

The subject is assessed according to 2 different types of assessment:

• 2 written tests (P1 and P2) of topics 1 and 2 (P1) and topics 3 and 4 (P2) with a weight of 90% (P1 and P2 each have a weight of 30%). This part can be recoverable in the final exam.

• Online problem solving with a weight of 10% and non-recoverable.

The final mark (NF) of the subject, as long as the marks P1, P2 are equal to or higher than 2.0 points, is calculated as:

NF = (P1 + P2) * (9/20) + (Pol1r + Pol2r + Pol3r + Pol4r) * (1 / 40)

If any of the grades P1, P2 are <2 and it is true that 5 >NF >=3.5, then NF=3.5

If any of the scores P1, P2 are <2 and it is not true that 5 >NF >= 3.5, then NF= min{P1, P2}

Due to academic needs, and according to the development of the course, the evaluation procedures may be adjusted by the teacher responsible for the subject.

This subject/module does not provide for the single assessment system

Recovery process:

• The final exam of the subject will consist of 2 different parts: Pr1 (topics 1 and 2) and Pr2 (topics 3 and 4), so that the marks Pr1 to Pr2 are obtained.

- The student can take the parts that he deems appropriate and the continuous evaluation note will be replaced in all cases by the one obtained in the recovery test. For example, if the student appears in parts 1 and 2 obtaining Pr1 and Pr2, the NF will be calculated exactly as described above but substituting P1 for P1r and P2 for P2r.

• Once the student begins the recovery exam, he must necessarily hand in some answer sheet for correction. In other words, the possibility of entering the examination room and leaving it without handing in anything for correction is not contemplated.

• With the recovery processes established in the subject, all students have the opportunityto be evaluated twice in each of the evaluation activities, except for evaluations related to online work, which are non-recoverable. For this reason, no additional evaluation tests will be done if a student cannot attend one or more of the tests.

Programming of evaluation activities:

• The calendar of the evaluation activities will be given on the first day of the subject and will be made public through the Virtual Campus and on the website of the School of Engineering, in the exams section. The defense of the online activities will only be published in the CV of the subject.

Evaluation for students repeating the subject:

• No differences with respect to first-time students

Procedure for reviewing the marks:

• For each evaluation activity, the procedure to review the activity will be indicated through the Virtual Campus of the subject. In this context, claims may be made about the grade for the activity, which will be evaluated by the teaching staff responsible for the subject.

Ratings:

- Evaluation with honors (MH): it is the decision of the faculty responsible for the subject. The regulations of the UAB indicate that MH can only be granted to students who have obtained a final grade equal to or greater than 9.0. You can grant a MH up to 5% of the total number of students enrolled.

• A student will be considered not evaluable (NA) if s/he does not obtain a minimum grade of 0.5 in P1, P2 or in their respective recovery (Pr1, Pr2).

Irregularities by the student, copy and plagiarism:

• Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an evaluation act will be graded with a zero. Therefore, copying, plagiarism, cheating, letting copying, etc. in any of theevaluation activities will involve suspending with a zero. The evaluation activities qualified in this way and by this procedure will not be recoverable.

• In this course, the use of Artificial Intelligence (AI) technologies is not allowed at any stage. Any work that includes AI-generated content will be considered a breach of academic integrity and may result in a partial or total penalty in the activity's grade, or more severe sanctions in serious cases.

Bibliography

1. Haykin /Van Ven, "Señales y sistemas", Limusa Wiley.
2. A. V. Oppenheim, "Signals and Systems", Prentice Hall.

3. A. B. Carlson, "Communication Systems", McGraw Hill.
4. Donald E. Scott, "Introducción al análisis de circuitos", McGraw Hill.
5. Leon O. Chua, "Linear and non linear circuits", McGraw Hill.
6. H. Baher, "Analog & digital signal processing", John Wiley.
7. Thomas Shubert, "Active and non-linear electronics".
8. A. Papoulis, M. Bertran, "Sistemas y circuitos", Marcombo.

Software

Not considered

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	311	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	312	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	331	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	332	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	511	Catalan	second semester	afternoon
(PAUL) Classroom practices	512	Catalan	second semester	afternoon
(TE) Theory	31	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	33	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	51	Catalan/Spanish	second semester	afternoon