Universidad de Alcalá

TEACHING GUIDE

Signals and Systems

Degree in
Telecommunication Technologies Engineering (GITT)
Telecommunication Systems Engineering (GIST)
Telematics Engineering (GIT)
Electronic Communications Engineering (GIEC)

Universidad de Alcalá

Academic Year 2021/2022

2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)

Approved by the School Board on July 6, 2021

TEACHING GUIDE

Course Name:	**Signals and Systems**
Code:	**350013 (GITT+GIST+GIT+GIEC)**
Degree in:	**Telecommunication Technologies Engineering (GITT)** **Telecommunication Systems Engineering (GIST)** **Telematics Engineering (GIT)** **Electronic Communications Engineering (GIEC)**
Department and area:	**Teoría de la Señal y Comunicaciones** **Signal Theory and Communications**
Type:	**Basic (GITT+GIST+GIT+GIEC)**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year - 1st Semester (GITT+GIST+GIT+GIEC)**
Teachers:	To be defined
Tutoring schedule:	To be known at the beginning of the term.
Language:	English

1. COURSE SUMMARY

Information is becoming fundamental in modern society, and its transmission and management technologies is evolving continuously. At first instance, transmitted data is what it is called signal within the context of the Information and Communications Technology, and any mechanism that processes a signal is referred to as a system. In order to understand the nature of the information, properties of signals and systems have to be tackled from a mathematical viewpoint.

The course Signals and Systems constitutes and introduction to the basic concepts of signals and systems, taking special attention into its description in the time and the frequency domains, because both descriptions are highly relevant for processing, storing, and transmitting information.

The contents of this course are the basics of the Information and Communications Technologies, and they come to be the starting point of other advanced issues such as Communication Theory in the second year, or Digital Signal Processing, Digital Communications, and Telecommunications Systems in the third year.

In following this course, students should have strong bases on complex algebra, integration, and derivation. Trigonometry should also be known as well as mathematical basics related to series, Fourier and Laplace transforms.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/352/2009:

en_TR2 - Knowledge of basic subjects and technologies that enables to learn new methods and technologies, as well as to provide versatility that allows adaptation to new situations.

en_TR3 - Aptitude to solve problems with initiative, decision making, creativity, and to communicate and to transmit knowledge, skills and workmanship, comprising the ethical and professional responsibility of the activity of the Technical Engineer of Telecommunication.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/352/2009:

en_CB4 - Understanding of: the basic concepts about linear systems and their associated functions and transform domains, theory of electrical circuits, electronic circuits, semiconductor physical principles, electronic and photonic devices, materials technology and its applications to solve engineering problems.

Learning Outcomes

After succeeding in this subject the students will be able to:

RA1. Applying appropriate procedure for identifying characteristics and properties of signal and systems in the time domain.

RA2. Identifying the existing relationship among the different representing domains of continuous-time signals and systems (time, frequency, Laplace) and learn how to use the best method for identifying characteristics of signals and systems and solving problems.

RA3. Identifying the existing relationship among the different representing domains of discrete-time signals and systems (time, frequency, z) and learn how to use the best method for identifying characteristics of signals and systems and solving problems.

RA4. Identifying the possibilities of z and Laplace domains to represent linear systems.

RA5. To distinguish the possibilities of the different transform domains depending on the kind of problem to be tackled and the scope of the application.

RA6. Identifying the utility of basic concepts of signals and systems in different application fields, such that communications and electronics.

3. CONTENTS

Contents Blocks	Total number of hours
Introduction. Basic concepts of signals and systems. Transformation of the independent variable, system properties.	6 hours: 3T+3P
Characterization of linear and time invariant systems. Convolution. Impulse response. System properties.	6 hours: 3T+3P
Analysis and characterization of continuous-time systems using the Laplace transform. Properties of continuous-time systems in the transform domain.	6 hours: 4T+2P
Fourier analysis for continuous-time signals and systems. Frequency analysis. Filtering and sampling.	16 hours: 8T+8P
Analysis and characterization of discrete-time systems using the z transform. Properties of discrete-time systems in the transform domain.	10 hours; 6T+4P
Fourier analysis for discrete-time signals and systems.	12 hours: 6T+6P

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (30 h in big groups, 26 h in small groups + 2 h for the assessment)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

The teaching strategy rely on a self learning model which allows the discovery and critical reflection of concepts that might be familiar and their application to problems.

For this purpose, lectures in big groups will be given by summarizing the most important ideas and coming up with additional needs arisen from learning based on problems. Master class will be used as the basic tool in this part of the term using other supports such as slides or computer-based exhibitions to ease learning.

In small groups, an active and participating strategy is proposed to strengthen the theoretical concepts, which may allow the verification of the evolution in the teaching-learning process. These reduced groups will be used for teachers to solve problems as well as to establish strategies to facilitate student learning, such as problem proposal to be solved by students, alone or in teams. Problems may be assessed by the teacher of by classmates. Discussion and analysis or results is also considered, as well as exhibition of solved problems.

Information and Communications Technology means might be used as training support activities (Internet, forums, email, available material in virtual learning platforms) and to achive the teaching-learning process.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Regulations for the Regulation of Teaching Learning Processes, NRPEA, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Regulations for the Evaluation of Apprenticeships (approved by the Governing Council on March 24, 2011 and modified in the Board of Directors). Government of May 5, 2016) as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

A continuous assessment system will be preferable, characterized as formative so that feedback of the teaching-learning process to students be possible. For this purpose, the following means are given.

Ordinary call

The assessment within the ordinary call is inspired in the continuous assessment criteria always paying attention at the specific competences achieved by the students.

a. Continuous assessment: It consists of the implementation and overcoming of the daily work of the subject and the overcoming of a final exam. The daily work will consist of the resolution of problems, multiple-choice tests, or theoretical reasonings delivered by the teacher. The purpose of this work is to show the more important aspects of each unit in order to guide the student in its progress.
b. Final assessment: For students who are not assessed under the continuous assessment, the assessment will be carried out with a final exam.

Extraordinary call

It consists of a final exam based on the resolution problems within a time range. Partial marks of the continuous evaluation will not be considered.

5.2. EVALUATION

EVALUATION CRITERIA

The aim of the assessment process is to determine whether the competences of the subject have been acquired by the student in sufficient extension and depth. As a result, the assessment criteria to be applied in the different tests will guarantee that the student has attained the appropriate level in the following knowledge and skills:

CE1: The student understands and applies correctly the basic tools for representing signals and systems in the time domain.

CE2: The student knows how to use the basic tools for representing continuous-time signals and systems in the different transform domains (Fourier, Laplace).

CE3: The student knows how to use the basic tools for representing discrete-time signals and systems in the different transform domains (Fourier and Z).

CE4: The student knows how to use the basic concepts of the different domains to characterize signals and systems.

CE5: The student understands the underlying information embedded in the transform domains about signals and systems, and knows how to use the more suitable domain to solve a specific problem.

CE6: The student can reasonably justify every step and stage accomplished to solve problems in the field of signals and systems.

GRADING TOOLS

This section describes the assessment tools to be applied to each assessment criteria.

1. Intermediate Assessment Test (PEI): It consists of the resolution of practical problems in classroom with limited time. To be done during the term.
2. Deliverable Work (E): Works carried out during the term, which consists of short problems, multiple-choice test delivered in classroom, preferably in small groups, or by means of virtual platforms.
3. Basic knowledge test (PBT): It consists of the resolution of a test to assess the theoretical knowledge needed to attain the results from learning of this subject.
4. Final Exam Test (PEF): It consists of the resolution of practical problems related to the distinct units of the course. It will be done at the end of the term.

GRADING CRITERIA

This section defines the weight applied to each assessment criteria to overcome the subject.

Ordinary call. Continuous assessment.

During ordinary call - continuous assessment, the relationship among criteria, tools, and qualification is as follows:

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2,TR3,CB4	RA1-RA6	CE1-CE6	E1-En	10%
	RA1,RA2, RA5, RA6	CE1, CE2, CE4, CE5, CE6	PEI	40%
	RA1-RA6	CE1-CE6	PCB	10%
	RA1-RA6	CE1-CE6	PEF	40%

10% of the continuous assessment mark is given by the work carried in small groups during the term. It will be achieved by active participation in classroom, proactivity, delivered works, proposed problems, and small tests.

40% of the mark corresponding to the continuous assessment will be given as a result of Intermediate Assessment Tests (PEI).

10% of the mark corresponding to the continuous assessment will be given by means of a test of basic knowledge.

40% of the mark corresponding to the continuous assessment will be the result of a Final Exam Test (PEF) of the full syllabus.

In order to overcome the continuous assessment, attendance to a minimum of 80% of the classroom lectures showed in this teaching guide is mandatory.

A student is considered not presented if he does not carry out the Final Exam Test (PEF)

Ordinary call, final assessment

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2,TR3,CB4	RA1-RA6	CE1-CE6	PEF	100%

Extraordinary call

The extraordinary call will consist of a final exam based on problem resolution within a time range. The results obtained during the continuous assessment will not be taken into consideration for the final mark.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
TR2,TR3,CB4	RA1-RA6	CE1-CE6	PEF	100%

Final Assessment:

The procedure and qualification criteria for this type of assessment will be identical in both calls.

CHARACTERISTICS OF THE CONTINUOUS ASSESSMENT TEST

Intermediate tests are not aimed at splitting neither the final exam nor the mark into partials. They are conceived to:

- To let the students know the assessment and marking criteria which were presented at the beginning of the term, by means of a real and objective test.
- To let the student assess the learning process that he has carried out as well as the competences and skills acquired.
- To provide to the faculty a way to assess how well the subject has been introduced and developed.
- The student will receive information from the results of the intermediate test so that he can assess, along with the teacher, the learning process, and to detect flaws and problems.
- Intermediate tests do not release material with respect to the final exam because the objective is the assessment of the competences acquisition. One of the most significant competence is the capacity of jointly applying and relating the acquired knowledge to solve problems.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Señales y Sistemas (Segunda edición). A.V. Oppenheim, A.S. Willsky y S.H. Nawab. Pearson Educación, 1998. ISBN: 970-17-0116-X.
- Señales y Sistemas. Ejercicios. Varios autores. Ciencia 3, 2004. ISBN: 84-95391-05-8.
- Continuous And Discrete Signals And Systems (Segunda edición). S.S. Samir y M.D. Srinat. Prentice Hall, 1997.ISBN: 0-13-518473-8

6.2. Additional Bibliography

- Signal Processing and Linear Systems. B. P. Lathi. Oxford University Press, 2000. ISBN: 9780195219173.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.