Last update: 30-06-2017

# 230363 - FSP - Fundamentals of Discrete-Time Signal Processing

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2017
Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 2,5 Teaching languages: English

## Teaching staff

Coordinator: Lamarca Orozco, M. Meritxell

## Teaching methodology

Lectures
Individual work
Matlab simulations

## Learning objectives of the subject

To characterize the application of LTI systems for discrete time signal procesing in the time domain. To be able to use the Fourier transform, DFT and z-transform for the characterization of signals and systems. To understand the relationship between an analog signal and its discrete-time representation in A/D and D/A conversion. To learn the characterization of random variables (both scalar and multivariate)..

## Study load

| | | | |
|---|---|---|---|
| Total learning time: 62h 30m | Hours large group: | 16h | 25.60% |
| | Hours small group: | 4h | 6.40% |
| | Self study: | 42h 30m | 68.00% |

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## Content

### Linear time-invariant systems

Learning time: 6h

Theory classes: 2h
Self study : 4h

Description:
Impulse response. Convolution.
Discrete-time systems characterized by difference equations. FIR and IIR systems.

### Signals and systems in the frequency domain

Learning time: 24h 30m

Theory classes: 6h
Laboratory classes: 2h
Self study : 16h 30m

Description:
Discrete-time Fourier transform. Definition, properties, examples and applications.
Discrete Fourier Transform (DFT). Definition, properties, examples and applications.
Sampling. Relationship between analog and digital spectrum. Nyquist criterion.

### Z-transform

Learning time: 12h

Theory classes: 3h
Laboratory classes: 1h
Self study : 8h

Description:
Z-transform. Definition, properties, examples.
Transfer function of a LTI system. Relationship with its frequency response.

### Random variables

Learning time: 14h 30m

Theory classes: 5h
Laboratory classes: 1h
Self study : 8h 30m

Description:
Random variable concept. Exemples: Bernouilli, uniform, Gaussian, exponential.
Distribution function. Probability density function.
Mean and variance.
Multivariate random variables. Independence. Correlation.

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## Qualification system

Assignments (100%)

## Bibliography

Basic:

Oppenheim, Alan V; Nawab, Syed Hamid; Willsky, Alan S. Signals and systems. 2nd ed. Essex: Pearson New International Edition, 2014. ISBN 9781292025902.

Papoulis, Athanasios; Pillai, S. Unnikrishna. Probability, random variables, and stochastic processes. 4th ed. Boston: McGraw-Hill, 2002. ISBN 0073660116.