



Course guides

230363 - FSP - Fundamentals of Discrete-Time Signal Processing

Last modified: 29/04/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).

Academic year: 2020 **ECTS Credits:** 2.5 **Languages:** English

LECTURER

Coordinating lecturer: Lamarca Orozco, M. Meritxell

Others:

TEACHING METHODOLOGY

Lectures
Individual work
Matlab simulations

LEARNING OBJECTIVES OF THE SUBJECT

To characterize the application of LTI systems for discrete time signal processing 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

Type	Hours	Percentage
Hours small group	4,0	6.40
Hours large group	16,0	25.60
Self study	42,5	68.00

Total learning time: 62.5 h



CONTENTS

Random variables

Description:

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

Full-or-part-time: 14h 30m

Theory classes: 5h

Laboratory classes: 1h

Self study : 8h 30m

Linear time-invariant systems

Description:

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

Full-or-part-time: 6h

Theory classes: 2h

Self study : 4h

Signals and systems in the frequency domain

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.

Full-or-part-time: 24h 30m

Theory classes: 6h

Laboratory classes: 2h

Self study : 16h 30m

Z-transform

Description:

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

Full-or-part-time: 12h

Theory classes: 3h

Laboratory classes: 1h

Self study : 8h

GRADING SYSTEM

Assignments (100%)



BIBLIOGRAPHY

Basic:

- Papoulis, Athanasios; Pillai, S. Unnikrishna. Probability, random variables, and stochastic processes. 4th ed. Boston: McGraw-Hill, 2002. ISBN 0073660116.
- Oppenheim, Alan V; Nawab, Syed Hamid; Willsky, Alan S. Signals and systems. 2nd ed. Essex: Pearson New International Edition, 2014. ISBN 9781292025902.