230691 - SPEE - Signal Processing for Electronic Engineering

**Coordinating unit:** 230 - ETSETB - Barcelona School of Telecommunications Engineering

**Teaching unit:** 739 - TSC - Department of Signal Theory and Communications

**Academic year:** 2019

**Degree:**
- MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
- MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Teaching unit Optional)

**ECTS credits:** 5

**Teaching languages:** English

### Teaching staff

**Coordinator:** Lamarca Orozco, M. Meritxell

### Prior skills

Characterization of discrete-time signals and systems, both in the time domain and in the transformed domain (Fourier transform, Z transform, DFT)

Analog signal sampling and reconstruction (sampling theorem)

Random variables

### Degree competences to which the subject contributes

**Specific:**
- CEE22. Ability to characterize deterministic and random signals in time or space, and in the frequency domain.
- CEE23. Ability to analyze, model, identify and simulate linear systems, especially digital filters and adaptive systems.

**Transversal:**
- CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

### Teaching methodology

**Activities:**
- Lectures
- Application examples
- Lab work with Matlab
- Exercises
- Team work (at home)
- Individual work (at home)
- Final exam

**Activities planning:**
- Exercises to strengthen theoretical knowledge.
- Lab work to implement processing techniques in Matlab.
- Final exam with theoretical questions and exercises.
# Learning objectives of the subject

Understanding the concepts and techniques of the field of statistical signal processing, and their use in real applications.

## Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>39h</th>
<th>31.20%</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
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## Content

### 1. Fundamentals of digital signal processing

**Learning time:** 15h  
Theory classes: 4h  
Laboratory classes: 1h  
Self study: 10h

**Description:**  
Introduction and applications  
Random variables and stochastic processes

### 2. Estimation theory fundamentals

**Learning time:** 23h  
Theory classes: 4h  
Laboratory classes: 3h  
Self study: 16h

**Description:**  
Bias, variance, mean square error  
Maximum likelihood estimation

### 3. Scalar quantization

**Learning time:** 9h  
Theory classes: 2h  
Laboratory classes: 1h  
Self study: 6h

**Description:**  
Uniform quantization  
Dithering

### 4. Sigma-Delta modulation

**Learning time:** 9h  
Theory classes: 2h  
Laboratory classes: 1h  
Self study: 6h

**Description:**  
Oversampling quantization  
Sigma-Delta modulation
## Qualification system

- **Final exam (including Lab work): 50%**
- **Individual/team assignments: 50%**
**Bibliography**

**Basic:**


**Others resources:**

**Audiovisual material**

**Teacher's material:** notes, problem sets, laboratory guides

**Resource**